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Albert Schaber

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LMU
LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN
MUNICH SCHOOL OF MANAGEMENT

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Albert Schaber*
Ludwig-Maximilians-University

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Abstract

This paper empirically analyzes a particular type of notes observed in securitization transactions: combination notes. Combination notes are formed by combining parts of two or more tranches of securitization transactions, where one part usually consists of a share of the first loss piece. It is analyzed whether combination notes are purely demand driven, or whether combination notes also appear to be structured to enable equity transfer. Results indicate that combination notes serve both purposes: market segmentation severely determines the structuring of combination notes, but risk transfer needs seem to be catered by combination notes as well. Further, an analysis of launch spreads indicates, that the observed equity transfer via combination notes has an impact on the pricing of the ordinary tranches of each deal. This paper makes use of unique data on 126 deals containing 1385 tranches, thereof 398 combination notes.

1 Introduction

Securitization of assets can be characterized by two prevailing structural elements. Several assets are assembled (pooling) to collateralize securities that are sold to financial markets in different tranches (tranching), with the principle of subordination usually being applied. The resulting notes are called asset backed securities (ABS). Securitization grew tremendously in the last decade, with different types of assets being securitized. The main categories are the securitization of mortgages (RMBS, CMBS), the securitization of consumer assets, and the securitization of debt claims (CDOs).[1] This paper focuses on one special note issued in securitization transactions: combination notes (also called combo notes). A combination note (CN) is

*Full address and affiliation: Institute of Capital Market Research and Finance, Munich School of Management, Ludwig-Maximilians-University, Schackstr. 4, 80539 Munich, Germany. Comments should be addressed to schaber@bwl.lmu.de, or +49/89/21802145. I thank Dr. Marco Krohn, HypoVereinsbank/UniCredit Global Research, for providing the data used in this study and for numerous helpful comments.

[1] The securitization of consumer asset is sometimes referred to as ABS, such as the securitization of assets in general.

constructed by combining parts of two or more tranches of a securitization transaction.[2] Usually, but not in every case, a CN comprises a share of the first loss piece (FLP), which is the most junior security of a securitization transaction, also known as equity piece or junior security. The creation of combination notes is not part of the original structuring process, which means that "plain vanilla" tranches are created first given the estimated portfolio loss distribution of the underlying asset portfolio, and combination notes result from combining parts of two or more of the "plain vanilla" tranches after their structure was determined. Furthermore, most CNs carry a rating assigned by one of the dominating rating agencies, and their existence is observed by market participants.

However, if capital markets were perfect and complete, neither combination notes nor securitization in general could add value to a firm. But market frictions exist, which can make securitization and also the creation of combination notes value creating.[3] From an originator's point of view, securitization in general can serve three main purposes: raising funds, risk transfer, and arbitrage. Considering combination notes in particular, several of these motivations might drive their issuance. Combination notes possibly facilitate equity transfer, which becomes more important due to the new regulatory framework Basel II.[4] But also asset managers that issue managed CDO transactions and that are not necessarily regulated, will prefer to transfer equity rather to retain it. On the one hand, asset managers' capital is limited. Selling a share of the FLP allows them to structure larger transactions respectively to increase their leverage or to increase their turnover. On the other hand, asset managers generate a substantial part of their income via fees, and therefore will prefer to transfer equity risk to market participants. From an investor's perspective, combination notes can facilitate the access to a certain risk-return profile, that might otherwise not be accessible due to investment restrictions, be them internal or external. Combination notes allow to participate in the residual income of securitization transactions, with the investment usually being rated at least investment grade, and the risk often being concentrated in the interest stream of the note but not in the principal amount.

While the above motives drive securitization in the market, their security design has been addressed in several theoretical contributions focusing on transaction costs, market incompleteness, and asymmetric information. To begin with, pooling

[2] According to Standard & Poor's, 2002, p. 143, CNs can also comprise parts of tranches of different deals, which however was not observed for any CN in the data used here. A structure that was observed three out of 398 times was the combination of equity with OATs (obligation assimilable du trésor, a French government bond).

[3] See Bluhm / Overbeck / Wagner, 2003, pp. 253-263 for a detailed description of originator and investor benefits of CDOs, Merchant (2004) for an introduction to the investor's point of view on CDO equity, and Brennan / Hein / Poon (2008) for an analysis of arbitrage CDOs.

[4] Under the new regulatory framework ("International Convergence of Capital Management and Capital Standards - A Revised Framework"), the distorting incentives to sell high quality assets while retaining low quality assets were mitigated in order to stop regulatory capital arbitrage. See Basel Committee on Banking Supervision, 2004, §§ 538-643, for the treatment of securitization transactions. As a result, selling the FLP has become more common in recent years, see International Monetary Fund, 2006, p. 56 and Fitch Ratings, 2005, p. 6. The extent to which equity pieces have been sold is so far unknown to regulators, greater transparency is discussed by market participants, see Fitch Ratings (2008).

of assets can reduce costs, when the trading of individual loans is costly.[5] Gaur et al. (2003) analyze market incompleteness and focus on a market where some but not all assets can be priced uniquely. They show that singling out new cash flow profiles increases market spanning, which is rewarded by a premium. Their results apply to securitization, where the optimal structure arises from the issuer's optimization. Problems due to information asymmetries can arise both ex-ante and ex-post. Ex-ante, the originator can be tempted to choose a poor average asset quality for the underlying asset pool, which bears the risk of adverse selection and hence market failure. Articles focusing on ex-ante asymmetries are Boot / Thakor (1993), Riddiough (1997), DeMarzo (2005), and Plantin (2004). Ex-post, investors of securitization transactions face moral hazard in case the value of the asset pool is a function of the originator's unobservable monitoring activity. Articles focusing on ex-post asymmetries include Gorton / Pennacchi (1995), Gorton / Souleles (2005), and Schaber (2008a). One stylized result of most of the above articles is the suggestion to retain the first loss piece in order to either send an appropriate signal to the market concerning asset pool quality in an adverse selection setting, or to provide the originator with the required incentives to mitigate moral hazard. The need to retain the FLP is relaxed in Plantin (2004) and Schaber (2008a). Plantin (2004) is the first to point out explicitly, that the FLP can be sold to sophisticated investors in case information production on the FLP is profitable to them—a result in line with Boot and Thakor (1993) but more specifically tailored to securitization transactions. Schaber (2008a) uses a repeated game argument to show that, even though the FLP is not retained, incentives to monitor the FLP can be maintained for the originator in a moral hazard setting.

Given that combination notes commonly comprise a share of the FLP, this paper is the first to analyze observed equity transfer in asset securitization empirically. Existing empirical evidence on securitization is still scarce, with Firla-Cuchra / Jenkinson (2005), Firla-Cuchra (2005), and Franke / Weber (2007) being the most important contributions for this research.[6] Firla-Cuchra / Jenkinson (2005) focus on the impact of market segmentation and asymmetric information on tranching and pricing of ABS, while Firla-Cuchra (2005) focuses on launch spreads only. Franke / Weber (2007) strongly focus on the impact of the underlying assets' quality on structural choices of CDO transactions such as the size of the FLP, the number of tranches, and the choice between true sale and synthetic structures. To my knowledge, combination notes so far have not been subject of closer examination, neither from academia, nor from market participants. The purpose of this article is to explore the properties of combination notes empirically in the context of existing evidence. Combination notes are interesting for various reasons. First, given combination notes commonly comprise some share of the first loss piece, equity transfer can be estimated. Second, rating of combination notes requires a closer examination, as the underlying share of equity is commonly not rated and rating methodologies vary for combination notes. Third, the tranching decision on combination notes can yield important insights. It can provide evidence, whether combination notes seem to be

[5] See Duffie / Gârleanu, 2001, p. 42, for a short discussion on transaction costs.

[6] For an extended version of Franke / Weber (2007) in English language see Franke / Herrmann / Weber (2007).

strongly demand driven, i.e. are structured to cater segmented markets, or equally reduce information asymmetries. Fourth, the structuring decision of the overall deal can reveal, whether combination notes are used as equity transfer vehicle. Fifth, the analysis of launch spreads can reveal whether the presence of combination notes has an impact on the pricing of securitization transactions. And sixth, combination notes are complex securities, and provide a venue for an analysis of the success of financial innovations.

This paper is unique, as it is the first to analyze combination notes, based on a manually collected dataset. It is also the first paper to shed some light on equity piece issuance, as general data on the distribution of equity pieces is not available. The paper is organized as follows. In section 2, research questions are formulated. Section 3 provides a description of the data and general insights on combination notes. Section 4 contains the empirical analysis. Section 5 concludes with a summary of major results.

2 Derivation of hypotheses on the structuring and impact of combination notes

The research questions formulated in this section can be grouped in two major blocks. One block addresses the question to which extend combination notes are tailored to investor needs and hence cater segmented markets, or if they equally resolve information asymmetries. The other block focuses on the risk transfer associated with combination notes. A minor research question focuses on the success of financial innovations, with CNs being an example for complex securities issued only in recent years. Different *explorative* hypotheses are lined out in the following.

Combination notes are securities that have special risk return properties and might face markets that are not very deep. The existence of limited demand capacity can make tranching beneficial as it might reduce price discounts or be even necessary to market CNs at all. Additionally, limited demand capacity might also place an upper bound on the transferability of equity of a single deal. This leads to the following hypotheses:

> *H1*: The number of combination notes increases with the absolute combination note volume in the deal.

> *H2*: The relative size of the combination notes in a deal will be negatively related to the overall size of the deal.

Taken together, H1 and H2 also imply a rather constant size of each single combination note. Aside, it can be suspected, that combination notes will carry a rating of at least investment grade, which will be elaborated in section 3. If combination notes were structured to reduce asymmetric information, combination notes should be tranched more given information asymmetries are higher, which leads to hypothesis 3:

> *H3*: The number of new rating classes added to the original number of rating classes by structuring combination notes will increase with increasing information asymmetries.

Rating classes is a term first introduced by Firla-Cuchra / Jenkinson (2005) and is the number of differently rated tranches in a deal. The difference between the overall number of tranches of a deal and the number of rating classes is called *market classes*, i.e. tranches that do not provide new information in terms of rating to capital markets and that are primarily structured to be marketable.[7] However, as the plain vanilla tranches are structured first, their tranching should reveal most information on the underlying loss distribution, and their repackaging in a combination note is not expected to release additional information on the loss distribution. Therefore, H3 is expected to be rejected.

Combination notes are a means to transfer equity. It shall hence be analyzed, whether risk transfer can be identified as a driver for the structuring and issuance of combination notes. Given combination notes are constructed to transfer equity risk, combination notes will be especially valuable when the quality of the underlying assets is comparably low and the FLP hence proportionally large. Furthermore, the share of equity comprised in combination notes cannot be increased arbitrarily in order to preserve marketability of the CN and to be able to obtain a rating on the CN. Selling more equity will therefore require to sell a larger combination note. Together, this results in hypothesis 4:

> *H4*: The relative size of the combination notes in a deal will be increasing with decreasing quality of the underlying assets.

The existence of combination notes is observed by market participants. As the majority of combination notes contains a fraction of the FLP, market participants have reasonable evidence to notice equity transfer. From the market participants' perspective, equity transfer is a positive signal on the deal structure: someone is directing his funds to the most subordinate tranche of the deal, which protects all other tranches issued in the deal. This positive signal can have an impact on pricing, and results in hypothesis 5:

> *H5*: Launch spreads on the plain vanilla tranches decrease with an increase in observed equity transfer.

Combination notes result from combining two or more non-trivial assets, and are therefore themselves complex securities. It can be argued that experience and reputation is necessary to successfully issue financial innovations such as combination notes, which results in hypothesis 6:

> *H6*: Combination notes are issued by experienced institutions with a positive track record on the market.

[7] To take an example, a transaction with two AAA tranches, one AA+ tranche, two AA tranches, one BBB tranche and one not rated FLP has four rating classes and three market classes. Market classes can however differ in other characteristics than rating such as currency and maturity. Throughout the paper, rating letters according to S&P and Fitch Ratings are used, which could equally be replaced by those of Moody's.

The above hypotheses will be tested in section 4. Given data availability, hypothesis 6 will only be discussed in section 3 and not tested in depth. Methodologically, the analysis will follow Firla-Cuchra / Jenkinson (2005) and Firla-Cuchra (2005) where possible in order to produce comparable results in this young field of empirical research.

3 Data description and combination note properties

3.1 General descriptive statistics

I use a unique dataset on European transactions, where the core data was compiled from an internal database at HypoVereinsbank/UniCredit Global Markets, which is fed by different sources such as Moody's, Fitch, Standard & Poor's, Bloomberg, and Reuters. Various variables concerning combination notes were manually collected using pre-sale and new issue reports by Moody's, Standard & Poor's, and Fitch. Overall, 130 deals that comprise 1433 tranches, thereof 406 combination notes, could be identified. This dataset spans a period from July 2002 until September 2007 and should cover the majority of combination notes issued in Europe in that period, however, notes that did not appear in any publication cannot be identified. Out of these deals, four were identified as outliers and removed from the data.[8] The data reduces to 126 deals, 1385 tranches, thereof 398 combination notes. All deals are backed by loans or bonds, with the majority (97) being leveraged loan securitizations, and the remainder being securitizations of ABS, mixed assets, CLOs, high yield bonds, and SME loans. The overall volume of these deals levels at 56.6 € billion, thereof 4.9 € billion equity.[9] Sponsors of these transactions are banks as well as asset managers.

Some information could be gathered on the asset managers involved in the deals. Fitch publishes a CDO asset manager rating (CAM). These ratings were assembled for the asset managers involved in the data where available, and translated into a numerical value, ranging from 7 (best) to 1 (worst).[10] These values were compared to all available Fitch CAM ratings, as reported in table 1. Doing so, it is assumed that all of the asset managers rated by Fitch Ratings are active on the CDO market.

[8] The outliers were removed for the following reasons. One deal was, due to super senior swaps, extraordinarily large with a deal volume of 2.9 € billion, which is three times larger than the second biggest deal in the data. One deal is a CFO, hence a securitization of hedge fund and/or private equity assets, that differs remarkably in its structure by having a FLP that covers 38% of the deal volume. Two deals comprise extraordinarily large combination notes that cover 60% and 75% of the deal volume, with the third largest relative CN size being 35%, which however is the CFO just mentioned to be excluded as well. The fourth largest relative CN size is at 24% only, so that the exclusion of these outliers seems reasonable.

[9] In case tranches have been issued in dollars, the dollar amounts have been converted to euros using the corresponding exchange rate.

[10] The exact mapping is as follows: CAM1=7, CAM1−=6, CAM2+=5, CAM2=4, CAM2−=3, CAM3=2 and CAM4=1. Fitch CAM ratings were collected from the Fitch web page in November 2007. The approach taken is rather crude, as ratings collected in November 2007 were used for the data ranging from 2002 to 2007, CAM rating migrations were therefore not taken into account.

Table 1: Asset manager ratings. Asset manager ratings are assembled from Fitch CDO asset manager ratings (CAM) and translated in a numerical value, with seven being the best and one being the worst score.

	Obs	Mean	Std. Dev.
all Fitch CAM ratings	58	4.483	1.442
in dataset by transaction	37	5.270	1.018
in dataset by asset manager	10	4.700	1.160

It can be seen that asset managers involved in structuring combination notes have an above average Fitch CAM rating. The effect is strong when averaging the asset manager rating by transaction, and only weak when averaging on an asset manager level (several asset managers appear more than once in the data). Taken together, these descriptive statistics indicate the importance of experience in structuring complex structures such as combination notes and can therefore be interpreted as support for hypothesis 6, which however can only be seen as a first step in its elaboration.

Rating information on the tranches is largely available in the dataset, the rating distribution can be found in table 2. Rating information was used in two ways, by using rating dummies and by generating numeric rating indices. Two indices have been generated, one without taking refinements into account, the *rating index*, and one with refinements, the *refined rating index*. For the rating index, AAA equals 10, AA equals 9, etc. For the refined rating index, AAA equals 22, AA+ equals 21, AA equals 20, etc., the entire mappings can be found in table 10 in the appendix. Ratings were collected from Standard & Poor's, Moody's, and Fitch. In case more than one rating was available and ratings differ, the index scores were averaged. However, split ratings were a minor problem, with 70 split ratings, thereof two split ratings for CNs and only two split ratings with a difference of two notches (A and AA-), all others with a difference of one on the refined index.[11] Here, a further remark is necessary: as data is partly collected from pre-sale reports, some split ratings arise due to differences in preliminary ratings and are therefore not necessarily real split ratings.

Descriptive statistics on the deal level can be found in table 3. Deals are on average 450 € million in size, with 7.83 plain vanilla tranches (when combination notes are not taken into account), thereof 4.85 differently rated tranches (rating classes), and 2.98 additional market classes. Rating classes and market classes were derived based on the refined rating index. Not rated tranches were considered being market classes. The mean of not rated tranches is at 1.04, with only four of the 131 not rated tranches not being equity pieces. Thus, roughly speaking, by counting not rated tranches as market classes the number of market classes per deal increases by one.

Additional variables were generated from the basic deal characteristics, such as

[11] Note that the rating index was derived from the refined rating index. Nine times, the refined scores lie exactly in between two rating grades (e.g. a score of 21.5 on the refined index). These were translated to the better rating grade on the rating index. Therefore, the rating index only takes integer values.

Table 2: Rating distribution.

Rating index	combination notes	plain vanilla tranches
5 (B)	3	6
6 (BB)	28	121
7 (BBB)	168	151
8 (A)	71	148
9 (AA)	31	146
10 (AAA)	57	284
not available	40	131
Nb tranches	398	987

Table 3: Descriptive statistics on the deal level. ex CN denotes variables that were generated without taking combination notes into account. Deal volume is in € million. Rating classes and market classes are defined according to Firla-Cuchra / Jenkinson (2005). Share of deal FLP is the size of the FLP divided by the overall deal volume. Size CN is the aggregate volume of all combination notes in a deal in € million. Share of deal CN is size CN divided by the deal volume. Tranche volume CN is the size of a single combination note in € million. Equity fraction of CN is the equity share in one CN. Deal equity transferred is the share of deal equity transferred with one CN. The number of observations N is 126, except for the last three lines, where N is reported with each variable.

Variable	Mean	Std. Dev.	Min	Max
Deal volume (€ mio)	448.92	149.46	199.95	1000.00
Nb tranches ex CN	7.83	2.00	2.00	20.00
Nb rating classes ex CN	4.85	0.79	1.00	6.00
Nb market classes ex CN	2.98	1.86	0.00	16.00
Nb tranches not rated ex CN	1.04	0.43	0.00	4.00
Share of deal FLP (%)	0.09	0.03	0.005	0.26
Nb CN	3.16	2.05	1.00	9.00
Size CN (€ mio)	26.28	19.55	1.00	94.19
Share of deal CN (%)	0.06	0.05	0.002	0.24
Tranche volume CN (€ mio) (N=398)	8.32	6.69	1.00	69.00
Equity fraction of CN (%) (N=56)	0.26	0.19	0.00	0.75
Deal equity transferred (%) (N=56)	0.08	0.12	0.00	0.70

an average rating score for the combination notes per deal, weighted average rating factors per deal, and a quarter index. The *average combination note rating* per deal is the value weighted average of the combination notes' rating using the rating index. However, when at least one CN rating is missing in a deal, the average CN rating is not calculated, as an average of the remaining CN ratings must not necessarily be a good proxy for all CN ratings in a deal. All CN ratings per deal and therefore the average CN rating are available for 98 deals.[12] The weighted average rating factor (WARF) per deal is based on rating factors published by Moody's and is used as proxy for the quality of the underlying assets. While the WARF published by Moody's relies on the individual loans of the underlying asset pool, the WARF derived here relies on the ratings of the tranches of each deal, as more detailed information on the underlying asset pool is not available. The rating factors provided by Moody's are derived from idealized default probabilities that depend on ratings and maturities.[13] I use rating factors for 10-year maturities (tabulated in table 10 in the appendix) and calculate the value weighted average of the tranches' rating factors for each deal, without taking the combination notes into account. The not rated first loss positions are treated as if rated CCC, as the lowest rated tranche in the dataset is rated B. As the relationship of ratings to the rating factors is non-linear, lower rated securities have a stronger impact on the WARF, which results in a better differentiation of the WARF compared to using a measure such as the average rating. In the empirical analysis, the WARF is rescaled by taking the natural logarithm, which results in *lnWARF* as proxy for the quality of the underlying asset pool.[14] A higher lnWARF indicates lower asset pool quality. The *quarter index* is a variable that captures the time structure of the dataset. It is set to one for the quarter of the first observation in the data (July 2002), increases by one each quarter, and ends at 21 for the quarter of the last observation in the data (September 2007).

3.2 Exploring the properties of combination notes

The number of combination notes issued per deal is 3.16 on average, the (aggregate) volume issued via combination notes per deal is 26.28 € million on average. A single combination note has a volume of 8.32 € million on average, combination notes account for 6% of the deal volume on average. Ratings on CNs differ and can address a rated balance that can differ from the principal balance, further ratings can address timely payment of interest and principal, ultimate payment of interest

[12] To make this more clear, consider a deal having three combination notes of equal size, two of them being rated AA, the third being not rated. When not considering the non rated CN, the average CN rating for that deal would be nine, however, the non rated CN could be of BB-quality, the average CN rating should rather level at eight. Therefore, the average CN rating is only calculated when a rating is available for all CNs in a deal.

[13] A tabulation of the idealized default probabilities can for example be found in Moody's, 2003, p. 19. Rating factors are derived by dividing the default probabilities by the default probability of an Aaa rated security of the same maturity. A rating factor of 80 hence indicates that the probability of default is 80 times higher than the probability of default for an Aaa rated security with equal maturity.

[14] Equally, the WARF could be retranslated into a rating using table 10, taking the natural logarithm however makes better use of the available information.

and principal, or ultimate payment of principal only.[15] Rating information is largely available on combination notes, as can be seen from table 2. Interestingly, only 31 combination notes are rated below investment grade, the majority of CNs (60%) is rated either BBB or A. The rating distribution of CNs can be seen as a first indicator that combination notes are tailored to specific investor needs, as a significant share of investors is likely to be obliged to hold only investment grade securities, be it due to internal or external constraints. Given an investor is liable to bank regulation, CNs will likely have required a risk weight of 100% under Basel I, which might have implied regulatory capital arbitrage. Under Basel II, the treatment of CNs depends on the specific structural features of each CN.

For 56 combination notes, that belong to 25 different deals, data on the actual note composition could be gathered. For theses 56 CNs the average share of equity comprised in one CN is 26%, and the average fraction of deal-equity transferred with one CN is 8%. Taking this last number, roughly 25% of each deal's equity was transferred, which results in an estimate for the overall equity transfer of 1.24 € billion for the 126 deals (3.16 CNs per deal × 8% of deal equity per CN × 4.9 € billion in overall equity).

Interestingly, 12 out of these 56 combination notes did not contain any equity and three times no equity was transferred via combination notes on the deal level at all. These three deals all only comprised one CN, two of them with a mix of A and BBB rated tranches, one with a mix of BBB and BB rated tranches. Especially the creation of the two CNs composed of shares of A and BBB rated tranches is puzzling, as not even a non investment grade security is transformed to investment grade, which is the case for the CN composed of BBB and BB rated tranches, as all of these 12 combination notes were at least rated investment grade. Most combination notes (47) were composed by parts of two tranches, five CNs were composed by parts of three tranches, two CNs by parts of four and equally two by parts of five tranches.

For all of these 56 combination notes, the rating is available. This rating is compared with a manually generated rating, the *CN rating revisited*. The CN rating revisited is the value weighted average of the CN components' ratings, based on the refined rating index.[16] In figure 1 the CN rating revisited is plotted against the true combination note rating. It can be seen that the actual rating for most combination notes is better than the manually calculated rating. Furthermore, none of the points lies substantially above the main diagonal. The dots are furthermore distinguished by the type of rating that is shown on the x-axis. Circles represent ratings that are assigned to the ultimate repayment of principal only, whereas triangles represent ratings that are assigned to the ultimate payment of principal and a rated coupon. Consistently, the ratings that include the coupon, are closer to the main diagonal, hence they are not substantially better than the manually derived CN rating re-

[15] For the rating agencies' approaches see Standard & Poor's (2004), Moody's Investors Service (2004), and Fitch Ratings (2007).

[16] A value of five is assigned to the FLP on the refined index, as the lowest rating in the data is a single B, which corresponds to eight on the refined rating index, and the FLP is considered being one entire notch down the rating scale. To take an example, a CN that consists of 30% AA, 30% BBB, and 40% equity is assigned a CN rating revisited of $0.3\times20+0.3\times14+0.4\times5=12.2$.

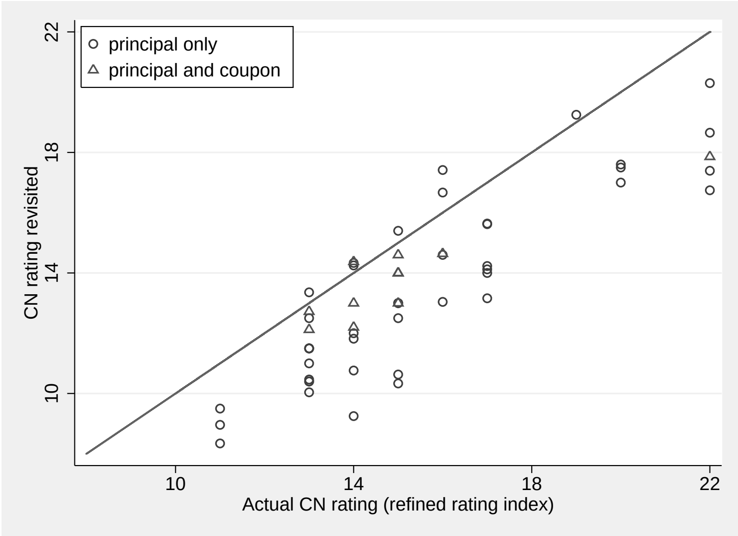

Figure 1: Actual rating CN vs CN rating revisited

visited. Overall, this can be seen as another indication that combination notes are tailored to specific investor needs.

For 52 combination notes, launch spreads are available as well.[17] However, these spreads must be treated carefully: from the data it is not possible to identify whether investors on these notes have a residual claim in addition to the spreads that appear in the data. As most of the combination notes comprise some equity, most CNs should comprise an upside potential even when a spread of a certain level is indicated. As launch spread on combination notes are too few and not obvious to interpret they are not used in the further analysis.

4 Empirical analysis

4.1 Empirical determinants of tranching

The tranching decision was analyzed in depth by Firla-Cuchra / Jenkinson (2005), denoted C/J henceforth. They analyze three main determinants of tranching: investor sophistication, market segmentation, and asymmetric information. Their main lines of thought are recapitulated in the context of this research in the following. C/J hypothesize and confirm, that tranching is increasing in investor sophistication. For the data used here, investor sophistication is unlikely to be an important fact, as the data spans a rather recent period, while C/J use data ranging from 1987-2003. However, the quarter index is included in the following analysis to control for possible effects due to sophistication of market participants.

Given that market segmentation exists, there should be more tranching. A higher level of tranching can attract a larger investor base and reduce negative price effects on large tranches. However, tranching is costly in two ways: tranching has operative

[17]Launch spreads are measured in basis points and denote the spread over the corresponding benchmark, usually the six-month Euribor for the tranches considered here.

costs, for example legal costs and fees being due to rating agencies. Second, tranching can also be costly in terms of post issue liquidity, as small tranches might not be marketable on secondary markets. C/J use the deal size to proxy for these effects of market segmentation. Large deals should be tranched more to be marketable on the primary market, small deals should be tranched less to keep costs down and to maintain post issue liquidity. This relation is confirmed by C/J and expected to hold here as well. However, opposed to C/J I believe that the lower degree of tranching of small deals is rather associated with primary market activities, not post issue liquidity on secondary markets: in case tranches become too small, marketing (from the originator's perspective) and research (from an investor's perspective) is not cost efficient. The natural logarithm of the deal size (in units of millions) will be included in the analysis to control for these effects.[18]

Concerning information asymmetries, C/J hypothesize, that a higher degree of asymmetric information should be associated with a larger number of tranches, especially of differently rated tranches. A higher number of rating classes releases more information on the underlying pool quality and therefore reduces information asymmetries. C/J construct an index that proxies the degree of information asymmetries, by ranking the different types of underlying asset classes according to their variability of launch spreads. Franke / Weber (2007) assume, that information asymmetries are higher for CLO transactions than for CBOs and use a CLO dummy as proxy variable for information asymmetries. As only very few transactions are classified as CLOs in the sense of Franke and Weber in this data, I instead use a leverage loan dummy, which is one in case the underlying assets are leveraged loans. For the leveraged loan dummy it can be argued similarly to a CLO dummy: information on leveraged loans underlying a securitization transaction are likely to be more difficult to obtain than information on publicly traded bonds or on tranches of CLOs and CDOs, the two other important types of underlying in the dataset. Comparing the volatility of launch spreads of the leveraged loan transactions to the volatility of launch spreads of the remainder of the dataset reveals that the volatility is higher among the leveraged loan securitizations. The volatility of launch spreads is calculated as the mean of the volatilities of launch spreads calculated per full letter rating grade. Furthermore, the ordering is not sensitive to the choice of a value weighted or equally weighted mean across the rating grades. Hence, the leveraged loan dummy is consistent with both the approach chosen by C/J and by Franke / Weber. Additionally, a level-management dummy is used as alternative proxy for information problems. The level-management dummy is one in case the deal is fully managed. For fully managed transactions, information problems tend to be more pronounced due to hidden action problems.

Several control variables are employed by C/J such as the quality of the underlying asset pool, actual bond market conditions, and WALs on the deal level (value weighted average of tranche WALs). The impact of the asset pool quality is ambiguous. While C/J hypothesize a positive relationship for the pool quality and the number of rating classes, a negative relationship is assumed by Franke / Weber (2007). Both C/J and Franke / Weber find some but limited support for

[18] All the natural logarithms on tranche and deal volumes are taken on the values in units of millions, i.e. for a deal of size 100 € million Ln deal volume equals Ln(100).

their hypotheses. Schaber (2008b), based on a transactions cost driven hypothesis, finds support for an increasing number of rating classes given a decrease in asset pool quality. Concerning the actual bond market conditions, C/J argue that severe bond market conditions require a more pronounced catering of investor needs and hence imply a higher number of market classes. C/J find that for a steep yield curve less rating classes and more market classes are issued. In the following, the lnWARF will be used to control for deal quality, while bond market conditions are captured by using the yield of ten year AAA Euroland government bonds provided by Datastream and the difference between ten year and two year AAA Euroland government bond yields. As the average WAL is available only for a subset of the data, it is not used in the following specifications, but results are robust to adding the average WAL.

Subsequently, three tranching decisions will be analyzed. First, tranching is analyzed without taking the combination notes into account, which serves as a reference case to C/J and to the further analysis. Thereafter, tranching within the combination notes and the tranching of combination notes in the deal context will be analyzed. The tranching decision within the combination notes of a deal can provide evidence on market segmentation, the tranching decision of combination notes in the deal context might shed light on the reduction of information asymmetries. The tranching decision is analyzed by running ordered logistic regressions. Some of the analyzed numbers of tranches are unequally distributed at the lower and the higher end. In that case, numbers of tranches below the 10% and above the 90% quantiles of the data are grouped together at the 10% respectively 90% quantiles of the relevant number of tranches. Further, the subsequently presented regressions do not violate the parallel regression assumption inherent to ordered logistic regression. As a further robustness test, poisson regressions have been run, with the major results being unchanged.

4.1.1 The benchmark case - tranching of plain vanilla tranches

The analysis of tranching without taking the combination notes into account should reveal results similar to C/J. However, models on the overall number of tranches and the number of market classes are not of statistical significance, which is probably due to the small sample size (126 deals compared to 1605 in C/J). Therefore, only the regression of the number of rating classes on all of the explanatory variables lined out above is reported in table 4. Only the leveraged loan dummy and the slope of the yield curve turn out statistically significant at the 5% level. The coefficient on the leveraged loan dummy, given it proxies for information asymmetries, shows the expected sign. When it is replaced by the fully-managed dummy, the coefficient on the fully-managed dummy is positive as well, but statistically not significant, while the coefficient on the lnWARF increases in size and turns statistically significant at the 1% level (not reported). Thus, the LL dummy could also proxy for a lower asset pool quality that is not captured in the lnWARF, and is associated with a higher degree of tranching, see Schaber (2008b). Hence, there is some but limited evidence that information asymmetries drive the creation of differently rated tranches, as well as there is some but limited evidence, that the number of differently rated tranches

Table 4: Tranching of plain vanilla tranches. Dependent variable is the number of rating classes without taking combination notes into account. Results are reported for ordered logit estimation. Heteroskedasticity-robust standard errors are are reported in parentheses. Significance of coefficients is indicated by asterisks, where ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Ln deal volume	LL dummy	lnWARF	Quarter index	Yield level	Yield slope
0.261	1.721**	0.135	-0.076	0.121	-2.313**
(0.613)	(0.671)	(0.345)	(0.101)	(0.459)	(0.929)
Sample size: 126		McFadden's R^2: 0.171		Prob > χ^2: 0.000	

rises with decreasing quality of the underlying asset pool. Consistent with C/J, the deal volume does not have a strong impact on the number of differently rated tranches. Further, increasing investor sophistication, proxied by the quarter index, does not have an impact in this comparable short time period. Again in line with C/J, the slope of the yield curve has a negative impact on the number of rating classes. As will be shown below, higher long term interest rates have an increasing effect on launch spreads, and hence make securitization more expensive. An increase in the slope of the yield curve hence can prevent the creation of tranches, likely at the bottom of a securitization structure, as these tranches become increasingly expensive to issue.

4.1.2 Tranching of combination notes

In this section, tranching within the combination notes is analyzed. For that purpose, the number of rating classes and market classes have been derived when *only* considering combination notes of each deal.[19] There are several not rated combination notes. Not rated CNs are considered as market classes, which is consistent with the approach taken for the plain vanilla tranches. However, counting not rated CNs as market classes could introduce a bias, as some of the not rated CNs are possibly rated but the rating is not available in the dataset. Therefore, the number of market classes was additionally derived without considering the not rated tranches as market classes, but results remain unchanged (not reported). In nine deals not a single CN is rated. These deals are dropped for the further analysis of rating and market classes, which results in 117 observations. On average, there are 2.39 rating classes and 0.85 market classes amongst the combination notes per deal, when not rated tranches are considered as market classes.[20] Again, ordered logit is estimated and regressions are run for the overall number of tranches, the number of rating classes and the number of market classes. The lnWARF is not considered as explanatory variable in this setting as a reasonable link between the underlying asset pool quality

[19] To take an example, a deal that comprises three combination notes, one rated AA and two rated A, comprises two rating classes and one market class among the combination notes, independent of the rating and number of plain vanilla tranches in the deal.

[20] The average number of combination notes in these 117 deals levels at 3.25, hence slightly above the average number of combination notes in the whole dataset as reported in table 3.

and the tranching decision within CNs cannot be established.

As stated in hypothesis 1, the number of combination notes is expected to rise with the absolute volume of combination notes in a deal. This relation should hold for the number of rating and market classes, but be stronger for the number of market classes, given there exists a negative relation for the size of a CN and its marketability. The data strongly supports this hypothesis, as can be seen from table 5. The coefficients on the aggregate CN volume are highly significant and of the expected sign for all the different dependent variables, and are larger for market classes than for rating classes. Predicted probabilities show that for small aggregate CN volumes the probability for only a single combination note and hence for a single rating class is very high, while in that case obviously a very high probability is assigned to zero market classes. Probabilities for higher numbers of rating and market classes rise with rising aggregate combination note volumes.[21]

As reported above, the leveraged loan dummy is associated with a higher number of plain vanilla rating classes. This must not hold for the tranching within combination notes for two reasons. First, combination notes are a combination of plain vanilla tranches and should therefore not reveal additional information on the underlying loss distribution. Second, the rating classes considered here are not necessarily unique ratings in the deal, as only the tranching within the CNs is considered. However, the coefficient on the LL dummy is positive and significant for the overall number of CNs and for the number of rating classes among the CNs. A possible explanation is that a higher degree of tranching on the level of plain vanilla tranches is associated with a higher degree of tranching of CNs, which will also be supported in the next section. Another explanation might be, that the average quality of the underlying assets in leveraged loan securitization is below the quality of the remaining transactions in the data, and lower quality assets are only marketable in smaller tranches. Adding the lnWARF to the model does remove the significance from the LL dummy for the second model (rating classes), while the coefficient on the lnWARF is positive and significant on the 10% level (not reported). The other two models are not substantially altered by adding the lnWARF. Investor sophistication, proxied by the quarter index, did not help to explain tranching in the section above. For combination notes, an increasing number of combination notes could be expected with the quarter index, as the market for combination notes might not have been as mature in 2002 as the securitization market in general, which however is not supported by the data. Again, it is controlled for the interest rate environment by using the slope and the level of the yield curve. Consistent with the results derived on plain vanilla tranching, the level of long term yields has a negative, statistically weak, impact on the number of all CNs and the number of rating classes.

[21] For a more detailed understanding, the following table presents predicted probabilities for the number of rating classes. Several discrete values of Ln size CN are evaluated, while all other variables of the model (model 2 in table 5) are held at their mean (the mean of size CN is at 26.28 € million, Ln(26.28) ≈ 3.27):

	$P(y=1 \mid x)$	$P(y=2 \mid x)$	$P(y=3 \mid x)$	$P(y=4 \mid x)$
Ln size CN = 1	0.9678	0.7382	0.2093	0.0242
Ln size CN = 2	0.027	0.2089	0.4175	0.1119
Ln size CN = 3	0.0044	0.0438	0.2838	0.3524
Ln size CN = 4	0.0009	0.0091	0.0895	0.5115

Table 5: Tranching of combination notes. Dependent variables are the number of combination notes per deal, the number of rating classes within the combination notes, and the number of market classes within the combination notes where not rated tranches are considered being market classes. Results are reported for ordered logit estimation. Heteroskedasticity-robust standard errors are reported in parentheses next to the coefficients. Significance of coefficients is indicated by asterisks, where ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent var.	all		rating		market	
Ln size CN	3.468***	(0.433)	2.366***	(0.355)	2.923***	(0.537)
LL dummy	0.815*	(0.443)	1.058**	(0.475)	−0.155	(0.530)
Quarter index	0.068	(0.156)	−0.003	(0.219)	−0.003	(0.202)
Yield level	−1.305*	(0.729)	−1.545*	(0.907)	0.454	(0.675)
Yield slope	0.639	(1.282)	−0.236	(1.620)	0.965	(1.446)
Sample size	126		117		117	
McFadden's R^2	0.347		0.291		0.361	
Prob $> \chi^2$	0.000		0.000		0.000	

Overall, the aggregated size of the combination notes in a deal strongly determines their tranching. For univariate regressions of the different dependent variables on the ln size CN variable, pseudo R^2s level at 32.9%, 25.4%, and 33.2%.

4.1.3 Tranching of combination notes versus the deal

In this last subsection on tranching, the tranching of combination notes is analyzed in the context of the existing deal structure. Again, rating and market classes are derived. Now, the number of rating classes amongst the combination notes is the number of *newly created* ratings when comparing the combination notes to the plain vanilla tranches of the deal. The remainder of the combination notes is classified as market classes.[22] Using this definition, the average number of rating classes among the CNs decreases to 1.2, the average number of market classes rises to 2.05. Ordered logit is estimated for two specifications, which are discussed in the following. In the first model specification, only the variables that were used when analyzing plain vanilla tranching are considered as explanatory variables. Using this first model, the impact of general deal characteristics on the tranching of combination notes versus the deal is analyzed. Model two controls for CN characteristics. The number of observations drops to 98 for the second specification as the average combination note rating is only available for that subset of the data.

For the first specification, the most interesting variable is the LL dummy. By structuring combination notes, it is possible to add new ratings to an existing securitization structure, captured as rating classes in this section. This new rating could possibly add additional information on the underlying asset pool and therefore re-

[22] To take an example: a deal that comprises one AAA, two AA+, one A, one BBB and one not rated FLP and additionally three combination notes, two of them rated AA-, one rated A, comprises one rating class and two market classes amongst the combination notes versus the deal, as one new rating in generated in the overall deal structure (AA-).

Table 6: Tranching of combination notes versus the deal. Dependent variables are the number of combination notes per deal, the number of rating classes of CNs versus the deal, and the number of market classes of CNs versus the deal. Results are reported for ordered logit estimation. Heteroskedasticity-robust standard errors are reported in parentheses below the coefficients. Significance of coefficients is indicated by asterisks, where ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Dependent var.	all	rating	market	all	rating	market
Ln deal volume	0.809	0.093	1.038	0.077	−0.683	0.840
	(0.687)	(0.797)	(0.643)	(1.268)	(0.978)	(0.861)
LL dummy	0.873**	0.277	1.170**	0.505	0.073	0.867
	(0.423)	(0.507)	(0.557)	(0.788)	(0.656)	(0.795)
lnWARF	0.170	0.610	−0.074	0.487	0.928	−0.787
	(0.209)	(0.385)	(0.283)	(1.007)	(0.582)	(0.904)
quarter running	0.160	0.017	0.097	−0.085	0.012	0.086
	(0.121)	(0.145)	(0.098)	(0.173)	(0.154)	(0.175)
Yield level	−1.494***	−1.075*	−0.654*	−0.355	−0.125	−0.172
	(0.455)	(0.574)	(0.395)	(1.118)	(0.695)	(0.722)
Yield slope	2.025**	0.562	1.715**	−0.091	0.253	1.481
	(0.922)	(1.091)	(0.742)	(1.558)	(1.153)	(1.342)
Ln size CN				3.390***	1.120***	2.204***
				(0.494)	(0.368)	(0.422)
Nb rating cl. ex CN				0.537**	0.385	0.399
				(0.268)	(0.249)	(0.300)
Average rating CN				−0.123	−1.021***	0.616**
				(0.269)	(0.294)	(0.271)
Sample size	126	117	117	98	98	98
McFadden's R^2	0.056	0.043	0.054	0.354	0.146	0.278
Prob > χ^2	0.001	0.023	0.001	0.000	0.005	0.000

duce information asymmetries, as stated in hypothesis 3. The data does not support this hypothesis: there is evidence that more CNs overall and more market classes are issued for LL transactions in specification one, but there is no impact of the LL dummy on the number of rating classes. The positive effect on the number of market classes can be explained by endogeneity rather than by economic reasoning: given that more (plain vanilla) rating classes are created for LL transactions as denoted in section 4.1.1, there are less (free) rating notches available to be filled by combination notes. Replacing the LL dummy by the fully-managed dummy (not reported) does neither indicate that CNs are structured to mitigate agency conflicts. Therefore, hypothesis 3 must be rejected. The three other additional general deal characteristics, the deal volume, the quarter index, and the lnWARF, do not have an impact on the tranching decision of CNs versus the deal. When looking at the interest rate environment, results are mixed, and opposed to the results derived above. However, pseudo R^2s are comparably low for all dependent variables for the first model specification, and adding the CN specific information in the second model specification removes all statistical significance from the coefficients of the first model.

In the second model it is controlled for the aggregate CN volume, the average rating of the combination notes, and the number of rating classes among the plain vanilla tranches. The pseudo R^2 rises sharply, the three variables have strong explanatory power. The size of the aggregate CN volume again is the dominating variable. The average combination note rating is endogenous in nature, but still helpful. As indicated by the coefficients, a high average CN rating implies less rating and more market classes among the CNs versus the plain vanilla tranches. Given that the rating distribution for the plain vanilla tranches is skewed towards high rating grades (more than 50% of all plain vanilla tranches are rated AA- or better, 32% are rated AAA), it is by definition less likely to generate a new rating class when the rating assigned to the CN is high. New ratings are more likely to arise for lower rated combination notes. The number of rating classes among the plain vanilla tranches is also endogenous in nature: given a high number of rating classes among the plain vanilla tranches the likelihood for creating a new rating class by a CN should fall. For the overall number of CNs, a positive relation can be observed with the number of rating classes among the plain vanilla tranches. Hence, sophisticated structuring of the deal is associated with the creation of more CNs. Surprisingly, the number of rating classes of the CNs versus the deal does not decreases with a rising number of rating classes among the plain vanilla tranches. Apparently the effect of a rising number of CNs outweighs the endogeneity of a higher number of rating classes among the plain vanilla tranches (less gaps to fill).

Summarizing the results, combination notes seem not to be structured to solve information asymmetries, hypothesis 3 can be rejected. Contrary, strong support is found for hypothesis 1: tranching of combination notes is almost entirely driven by segmentation effects. This result suggests, that combination notes are only marketable below a certain size and implies a fairly constant absolute size of combination notes. As noted above, the average volume of a single CN is at 8.32 € million, with a standard deviation of only 6.69 € million, a minimum value of 1 € million, a maximum of 69 € million, and the 95%-percentile at 20 € million. Additionally, the more sophisticated the original structuring of the deal, the higher the number of CNs. New rating classes versus the deal arise mainly at low ratings. There is no evidence that CNs are specifically tailored to fill rating gaps among the plain vanilla rating classes.

4.2 Combination notes and risk transfer

4.2.1 Measuring equity transfer

It was shown above, that CNs are mainly structured to cater segmented demand, but not to transmit additional information on the underlying asset pool by their tranching. From an originator's perspective, combination notes mainly are a means to repackage and transfer equity. As noted above, for a subset of the data the exact composition of combination notes is available, with an average deal equity transfer of 8% by each single CN. To be able to test hypotheses concerning the equity transfer via combination notes such as H2, H4, and H5 for the entire dataset, a risk respectively equity transfer proxy is necessary. Two variables capture the amount of equity transfer: the relative size of the aggregate combination note volume per deal, and the average rating of the combination notes per deal. As lined out in section 3.2 the average equity fraction per single CN is at 26%, with a standard deviation of 19% for the subset of 56 CNs. Further, the equity fraction of the single CNs is found to be independent of the size of the relevant CNs. Hence, given a comparably constant relative equity fraction per combination note, the share of equity transferred on a deal level will rise with the relative CN volume in a deal. Testing this relation on the 19 deals where the exact CN composition is known for all CNs, it is strongly supported: the fraction of deal equity transferred rises in the relative size of the CNs of the deal.[23] Hence, even though there is variation in the equity fraction per CN, a larger relative CN volume strongly indicates that more equity is transferred to the market. Therefore, the relative size of the aggregate CN volume per deal can serve as a measure of equity transfer, and is called *share of deal CN*. The variation in the equity fraction per CN could be captured in each CN's rating, a larger equity fraction implies a lower rating. This information was captured in a former version of this paper to derive an equity transfer proxy that equalled the share of deal CN divided by the average combination note rating of the relevant deal. The proxy variable showed similar but slightly weaker results than when using the share of deal CN variable on a stand alone basis. This can be due to a reduction in the sample size but also to the ambiguity concerning the meaning of combination note ratings (rating to a rated balance, principal only ratings, etc.). Subsequently, results are only reported for the share of deal CN variable.

4.2.2 Equity transfer and deal characteristics

Hypotheses 2 and 4 both make a prediction about the relative size of the combination notes in a deal. H2 states that the relative size of the CNs in a deal will decrease with the volume of the deal due to a limited market capacity for equity of a single transaction. H2 can hence provide further support for the idea of segmented markets. H4 states that, as it is not possible to arbitrarily increase the amount of equity in a single CN, the relative CN volume will rise for a lower deal quality, assuming that risk transfer is a transaction motive. Support for this hypothesis would indicate, that CNs are indeed structured as equity transfer vehicles.

To test these hypotheses, two ordinary least squares regressions are run with the share of deal CN as dependent variable. The explanatory variables of most interest are the deal volume (used in logarithmic form) and lnWARF as proxy for the quality of the underlying assets, which are tested on a stand alone basis in model I. Several control variables are added in model II. The time structure is captured by the quarter index. Proceeding in time could have different implications for the amount of equity transfer: investors might be more familiar with CNs and be willing to buy larger CNs, or CNs that comprise more equity. Contrarily, as equity pieces are being sold more often directly in recent years, the issuance of CNs might become less important to originators. The number of rating classes among the

[23] An univariate OLS regression of the fraction of deal equity transferred on the relative size of the CNs results in a highly significant coefficient of about four on the relative size of the CNs, and a R^2 of about 76%.

Table 7: Equity transfer and deal characteristics. Dependent variable is share of deal CN. OLS is estimated. Heteroskedasticity-robust standard errors are reported in parentheses next to the coefficients. Significance of coefficients is indicated by asterisks, where ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

	I		II	
lnWARF	0.010***	(0.004)	0.008*	(0.004)
Ln deal volume	−0.025**	(0.012)	−0.022*	(0.012)
Quarter index			0.004*	(0.002)
Nb rating cl. ex CN			0.018***	(0.005)
Yield level			−0.019*	(0.011)
Yield slope			0.060***	(0.017)
Constant	0.149*	(0.082)	0.044	(0.094)
Sample size	126		126	
Adjusted R^2	0.037		0.181	
Prob > F	0.001		0.000	

plain vanilla tranches should have a positive impact on the equity transfer, because a higher number of plain vanilla rating classes is associated with a higher number of CNs. Level and slope of the yield curve again are used to control for market conditions. Given the pure expectations theory, a steep yield curve is associated with rising interest rates, and hence less favorable future market conditions from the originator's perspective. More generally, a steep yield curve should be related to an overall favorable macroeconomic environment and might facilitate equity transfer due to low levels of risk aversion. A steep yield curve should hence be associated with high selling activities, and therefore also with a higher degree of risk transfer. The leverage loan dummy is not considered as control variable, as, from a risk transfer perspective, there should not be a difference on the specific type of underlying.[24]

Table 7 presents the results which support H2 as well as H4. Concerning H2, coefficients on the deal volume are of the expected sign and significant at 5% and 10%. Estimates in model I indicate, that an increase of 10% in the deal size roughly reduces the share of deal CN by about 0.0025 in absolute terms (the mean value for the share of deal CN is at 0.06). Hence, the market for combination notes of a single deal and therefore equity seems to be bound from above. Concerning H4, estimates in model I indicate, that an increase of the lnWARF by one induces an increase of the share of deal CN of 0.01. An increase of the lnWARF by one would for example roughly correspond to a move from an on average A-rated asset pool to an on average BBB-rated asset pool. This positive and statistically significant relation indicates, that CNs are used as risk transfer vehicle by their originators. The control variables add additional insights and remove some significance from the deal volume and the lnWARF. There is weak support that equity transfer increased during the sample period, which might be linked to rising investor sophistication. Coefficients for the

[24]The LL dummy turns out not significant when added to the analysis, but removes explanatory power from the lnWARF variable. This again indicates a lower quality of leveraged loan transactions.

number of plain vanilla rating classes and the slope of the yield curve are as expected and highly significant. The number of plain vanilla rating classes and the slope of the yield curve explain a substantial fraction of the variation: when only using these two variables as explanatory variables, adjusted R^2 levels at 13.6%. Dropping both the deal volume and lnWARF from model II reduces the adjusted R^2 to 15.8%.

Several robustness checks have been performed and are lined out in the following, but not reported. The lnWARF was replaced by the relative size of the FLP. The relative size of the FLP equally is a proxy for a lower deal quality, however not as comprehensive as the lnWARF. Coefficients on the relative size of the FLP are positive, hence in line with H4, but not statistically significant in most specifications. Equivalent regressions have been run on the subsample of 19 deals where the true CN compositions are available, with the volume of equity truly transferred via CNs as a share of the overall deal volume as dependent variable. Signs of all coefficients remain unchanged, coefficients in model I loose their significance, significance of coefficients in model II either remains at the levels reported in table 7 or increases. Further, given that the share of deal CN variable is a fractional dependent variable, a generalized linear model following Papke and Wooldridge (1996) was estimated, using a logit link and the binomial family. Results remain almost unchanged, the significance of the coefficient on the deal amount increases to the 5% level in model II. Marginal effects evaluated at the means of the regressors are very close to the coefficients obtained using OLS. Overall, even though the control variables explain a substantial fraction of variation in the data, the coefficients on the deal amount and the lnWARF have the expected sign, are statistically significant, and robust to alternative model specifications.

4.2.3 Equity transfer and launch spreads

Empirical literature on bond spreads grew strongly in recent years, with several articles focussing on corporate bonds.[25] Studies on the pricing of asset backed securities are still rare. Boudoukh et al. (1997) examine the pricing of MBS by the level and slope of the yield curve. Scheicher (2008) examines spread changes on CDS index tranches of the iTraxx and the CDX. Longstaff and Rajan (2008) decompose CDX spreads into three major components: idiosyncratic risk, sector default risk, and systemic risk. The two closest related studies to the analysis presented here are Firla-Cuchra (2005) and Firla-Cuchra and Jenkinson (2005) (C/J). Both focus on launch spreads of ABS in level form, just as the remainder of this section will do. Firla-Cuchra (2005) finds that launch spreads are well described by credit ratings without refinements, but variables associated with liquidity, market segmentation, distribution efforts, and the prevailing legal regime can explain further variation in launch spreads. C/J analyze the impact of tranching on pricing of ABS. They find that a higher number of predicted rating classes reduces launch spreads, while it is controlled for all common pricing factors.

The purpose of this section is to examine whether the amount of observed equity transfer proxied via combination note properties has an impact on the pricing of plain

[25] See for example Duffee (1998), Elton et al. (2001), Collin-Dufresne et al. (2001), Perraudin / Taylor (2003), Campbell / Taksler (2003), Driessen (2005) and Amato / Remolona (2005).

vanilla securities, hence hypothesis 5 is tested. Combination notes are observed by market participants, and could be a positive signal to plain vanilla tranche investors: some other market participant is directing funds towards a share of the FLP, the most subordinate security of the deal, that protects other investors. An investment in that security by a market participant could hence be interpreted as quality signal for the deal in general, and hence imply lower launch spreads. Again, the share of deal CN variable is used to measure the equity transfer. Methodologically, the following analysis is equivalent to C/J and Firla-Cuchra (2005). The majority but not all explanatory variables used in C/J and Firla-Cuchra (2005) are used in this study. Dependent variable is the natural logarithm of launch spreads, with almost all launch spreads referring to Euribor. Combination notes, equity pieces, fixed rate issues, zero bonds, and super senior swaps are excluded from the analysis, which reduces the data to 766 floating rate notes. The origination spread is available on 718 of these floaters, belonging to 124 deals. Two different approaches are taken in the following. First, all launch spreads are analyzed in a pooled regression, the tranche's rating is captured by rating dummies or the refined rating index. Second, tranches are organized according to their rating and launch spreads are analyzed within the different rating categories to derive a better understanding of pricing factors beyond ratings.

For the first approach, seven models are estimated by OLS, considering three groups of explanatory variables: credit rating information, interest rate parameters, and deal respectively tranche specific information. Standard errors are heteroskedasticity robust, and the estimation of standard errors accounts for the fact, that tranches are not necessarily independent within a deal, but independent for different deals. Results are reported in table 8. Model I only uses rating dummies without refinements, with A being the omitted credit rating. Rating dummies were derived from the rating index, and are hence based on average ratings in case differing ratings from more than one agency were available. All coefficients are significant at 0.1%. Comparing the results to Firla-Cuchra (2005), R^2 is significantly higher, at about 90%, while Firla-Cuchra reports an R^2 of 71.9% when only controlling for rating.[26] This strong difference could be due to two reasons: while the data used here is very homogeneous in types of underlying assets and the time period is comparably short, data used by Firla-Cuchra spans over 16 years and is based on various underlyings. However, even when controlling for the time dimension and types of underlying, but also for deal characteristics and market conditions, R^2s reported by Firla-Cuchra and C/J are clearly below the 90% reached here. The reason for the high level of R^2 observed here might be that even within the category of collateralized debt obligations, the underlying is very homogeneous in the data with 97 leveraged loan deals out of 126 deals. Model II adds the share of deal CN variable. Given H5 holds, the sign on the coefficient should be negative, which is confirmed by the data, however the coefficient is not statistically significant and the R^2 remains unchanged.

The second set of controls are the level and slope of the yield curve, again measured by the 10 year yield on AAA Euroland government bonds provided by Datastream and the difference in 10-2 year yields, both used on a weekly basis and in units

[26] See Firla-Cuchra, 2005, p. 14, model III.

of percentage points. Using this specification, the two year yield is also fully incorporated in the analysis, captured in the slope variable when holding the ten year yield fixed. Model III adds these two interest rate parameters to model I. R^2 rises by about 5%, coefficients are significant at 0.1%. The interpretation of coefficients needs to be done carefully. An absolute increase in the two year yield of 10 basis points (i.e. a decrease of the slope keeping the ten year yield fixed) leads to a reduction of launch spreads of about 3.8%. This is consistent with empirical findings by Duffee (1998) and with the contingent claims analysis on corporate bonds by Longstaff and Schwartz (1995). Contrary, an increase of 10 basis points on the ten year yield is associated with launch spreads being about 6% higher, considering the coefficients on the level and the slope holding the two year yield fixed. These results on the long term yield and the slope differ from existing evidence. The slope of the yield curve is rather expected to have a negative effect on credit spreads: a steep yield curve is associated with a sound economic climate, with implies comparably high recovery rates and thus lower credit spreads. Further, following the expectations theory, a steep yield curve is associated with rising future short rates, which should result in lower credit spreads due to the results obtained by Longstaff and Schwartz (1995).[27] This negative relation is confirmed by Duffee (1998), as he finds a negative coefficient for increases in long term yields. Campbell and Taksler (2003) find only limited support with changing sign for the coefficients on the slope. Collin-Dufresne et al. (2001) find a strong negative relation between long term interest rates and bond spreads, but only weak statistical significance for the slope coefficient. Scheicher (2008) finds mixed and comparably weak results concerning the impact of changes in the level and the slope of the yield curve on changes of index tranche spreads. Coefficients are only significant for the level of the yield curve and only when it is controlled for the time period of the subprime crisis, furthermore coefficients differ for the iTraxx and the CDX. Firla-Cuchra's results also differ from the results obtained here. Firla-Cuchra uses the ten year yield and 10-2 year swap yields. In that specification, he finds a negative coefficient on the slope for most model specifications, indicating a positive impact of higher short term interest on launch spreads. Looking at the level and slope together, Firla-Cuchra's results indicate a negative impact of higher long term interest rates on launch spreads. Coefficients however are not significant when only focussing on CDOs.[28] Results from C/J are similar to those from Firla-Cuchra (2005).[29] Given the differences to my results concerning the level and the slope of the yield curve and its impact on launch spreads, I tested the relationship on a comprehensive dataset of CDO origination spreads containing over 3000 observations, results remain similar to the results presented in tables 8 and 9. Theses differences, especially to the findings by Firla-Cuchra, highlight the need for further research on the pricing of bundled credit risk on primary markets.

[27]See Collin-Dufresne et al. (2001) for these arguments.

[28]See Firla-Cuchra, 2005, p. 20, table 5, model V.

[29]Firla-Cuchra additionally controls for interest rate volatility to capture possible effects of the value of prepayment options on the launch spread. Prepayments are not an issue for the data of European CDOs used here, the interest rate volatility is thus not considered.

Table 8: Launch spreads and risk transfer (i). Dependent variable in all regressions is the natural logarithm of each tranche's launch spread. OLS is estimated. Heteroskedasticity-robust standard errors are reported in parentheses, with the clustering of tranches within deals being taken account of. All regressions include a constant, which is not reported. Significance of coefficients is indicated as follows: bold coefficients are significant at 0.1%, bold and italic coefficients are significant at 1%, and coefficients with one asterisk are significant at 5%.

	I	II	III	IV	V	VI	VII
Dummy AAA	**-0.974**	**-0.974**	**-0.966**	**-0.964**	**-0.795**	**-0.783**	
	(0.022)	(0.022)	(0.017)	(0.017)	(0.040)	(0.039)	
Dummy AA	**-0.453**	**-0.453**	**-0.466**	**-0.466**	**-0.434**	**-0.430**	
	(0.033)	(0.033)	(0.023)	(0.022)	(0.019)	(0.018)	
Dummy BBB	**0.829**	**0.829**	**0.827**	**0.829**	**0.793**	**0.792**	
	(0.029)	(0.029)	(0.019)	(0.019)	(0.018)	(0.018)	
Dummy BB	**1.736**	**1.736**	**1.757**	**1.758**	**1.710**	**1.704**	
	(0.032)	(0.032)	(0.020)	(0.020)	(0.025)	(0.026)	
Dummy B	**1.925**	**1.925**	**2.078**	**2.092**	**1.999**	**1.990**	
	(0.054)	(0.054)	(0.073)	(0.064)	(0.055)	(0.053)	
Refined rating index							**-0.216**
							(0.003)
Yield level			**0.215**	**0.191**	**0.227**	**0.209**	**0.201**
			(0.048)	(0.045)	(0.038)	(0.035)	(0.037)
Yield slope			**0.384**	**0.410**	**0.350**	**0.381**	**0.400**
			(0.033)	(0.032)	(0.033)	(0.033)	(0.034)
Share of deal CN		-0.013		**-1.087**		***-1.049***	***-1.041***
		(0.538)		(0.303)		(0.321)	(0.323)

continued on next page

Table 8 continued

	I	II	III	IV	V	VI	VII
Ln deal volume					-0.003	-0.025	-0.029
					(0.048)	(0.045)	(0.045)
Ln tranche volume					**-0.074**	**-0.078**	**-0.054**
					(0.012)	(0.012)	(0.010)
Share of deal FLP					0.859	0.919	0.283
					(0.788)	(0.771)	(0.789)
Credit enhancement					-0.270*	***-0.289***	-0.015
					(0.114)	(0.110)	(0.098)
Nb rating classes ex CN					-0.008	0.014	0.005
					(0.022)	(0.024)	(0.024)
LL dummy					***-0.177***	***-0.168***	***-0.155***
					(0.054)	(0.052)	(0.055)
Sample size	718	718	718	718	718	718	718
Adjusted R^2	0.899	0.899	0.952	0.955	0.962	0.964	0.948
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Clusters	124	124	124	124	124	124	124

Reconsidering equity transfer and launch spreads, the share of deal CN variable is again added to the regression in model IV. The coefficient on the share of deal CN has the predicted negative sign and is significant at 0.1%. An increase of the relative aggregate CN volume in a deal by 0.01 implies a decrease of launch spreads of approximately 1.1%. However the R^2 remains almost unchanged.

The last set of control variables are deal and tranche specific information and are added in model V. It is controlled for the size of the deal a tranche belongs to and the size of each tranche itself. The deal and tranche size can possibly have two opposing impacts: while a large deal or tranche might be more difficult to market and hence more expensive to place in segmented markets, the liquidity of large deals or tranches on secondary markets will be greater. Firla-Cuchra (2005) finds a negative coefficient on the overall deal volume but a positive coefficient on the tranche size, which indicates that on a tranche level there is a negative effect of demand on price (i.e. higher launch spreads), but that on the deal level the liquidity effect is dominant.[30] Results found here indicate that the liquidity effect is dominating on the tranche level as well, as all coefficients are highly significant and of negative sign. Coefficients on the deal size are negative as well, but not significant in any specification.

Furthermore it is controlled for the share of the FLP on the deal, the level of credit enhancements, the number of plain vanilla rating classes, and the leveraged loan dummy. The share of the FLP on the overall deal volume could have a similar impact as the share of the CNs on the deal volume: a bigger first loss position allows more defaults to happen until a plain vanilla tranche is hit. However, as the credit ratings basically arise from the structuring process and hence also from the size of the FLP, the variable is not expected to have explanatory power, which is confirmed by the data.

There are various possibilities of credit enhancements in securitization transactions.[31] The credit enhancement captured here is the fraction of the deal subordinated to the relevant tranche of interest. Information captured in the credit enhancement is hence closely related to the rank in deal of the relevant tranche, therefore only the credit enhancement is used. The credit enhancement captures additional information, that is not captured in the credit rating, as even within a rating category, enhancement levels can differ according to the rank in deal. A negative coefficient is expected as a higher enhancement level indicates higher protection in case of defaults in the underlying asset pool. Credit enhancement is significant on 5% and 1% in models V and VI and of the expected sign.

C/J show that the number of rating classes has a negative impact on launch spreads. While they predict the number of rating classes from an ordered logit model on the optimal number of rating classes, the actual number of rating classes is used here. The findings of C/J are not supported by the dataset used here, which is also robust to using the predicted number of rating classes (not reported).

Finally, it is controlled for the LL dummy, given the large fraction of leveraged loans in the dataset. The LL dummy is significant at the 1% level and has a negative sign. This negative effect on launch spreads could be due to the higher degree

[30] See Firla-Cuchra, 2005, p. 23, table 6.

[31] See Hein (2006) for a simulation-based analysis of internal credit enhancements.

of tranching found for leveraged loan transactions. But as this effect should be captured in the number of rating classes, the negative coefficient is surprising, even more so as the LL dummy is also supposed to proxy for information asymmetries. However, due to missing values on the weighted average life (WAL) of the securities, it was not controlled for the WAL, even though the WAL should be of importance when analyzing launch spreads. The analysis was equally performed when using the subsample where the WAL is available (not reported), the sample size reduces to 610 tranches. The WAL is significant for some specifications with a negative coefficient, and removes explanatory power from the LL dummy in models V-VII. The remaining results are almost unchanged.

Again, the share of deal CN variable is added to the set of explanatory variables in model VI and is significant at 1%, while coefficients on all other variables and the R^2 are not largely affected.

In model VII, the rating dummies are dropped and instead the refined rating index is used, capturing more information than the full letter grade rating dummies but on a linear scale. This inclusion of rating refinements removes the size of the coefficient on the credit enhancement and its significance, while there are no substantial changes on the other coefficients.

Summarizing the findings up to this point, four observations can be made. First, rating without refinements explains almost all variation in launch spreads. Second, the level and slope of the yield curve further help to explain launch spreads. However, the effects of the interest rate environment are not fully in line with existing literature and merit further investigation. Third, the equity transfer proxy has the expected sign, and is statistically significant in three out of four specifications. However, the maximum increase in adjusted R^2 by adding the equity transfer proxy is only in the dimension of three-tenth of a percent. And fourth, results on the control variables are in line with expectations.

To better disentangle the effect of observed equity transfer via combination notes on launch spreads, data is rearranged by the rating categories AAA to BB (only six tranches are rated single B), and the regressions are run again within each rating group. Results are reported in table 9. All explanatory variables are considered again, however the beforehand dominating rating information is eliminated by this grouping of data.

Several observations are of interest: the coefficient on the tranche volume is only strongly present for AAA-rated securities. This indicates, that on a tranche level post issue liquidity matters for senior securities only, while markets for lower rated securities seem to be segmented and the placement of large tranches not beneficial from an issuer perspective. Additionally, the deal volume has a negative impact on lower rated tranches, significant for A rated securities. Hence, there is some evidence, that for not AAA rated tranches, the marketability is increasing with the overall deal volume. Further, the credit enhancement is equally only an important determinant of launch spreads for AAA rated securities. This result is puzzling, as the credit enhancement should capture additional information versus the credit rating. Inspecting the data reveals, that variation within the credit enhancement is only substantial for AAA rated securities, and credit enhancement levels become more and more similar when moving down the rating grades. Hence, while for senior

Table 9: Launch spreads and risk transfer (ii). Dependent variable in all regressions is the natural logarithm of each tranche's launch spread, grouped by rating category according to the column headings. OLS is estimated. Heteroskedasticity-robust standard errors are reported in parentheses, with the clustering of tranches within deals being taken account of. All regressions include a constant, which is not reported. Significance of coefficients is indicated as follows: bold coefficients are significant at 0.1%, bold and italic coefficients are significant at 1%, and coefficients with one asterisk are significant at 5%.

	AAA	AA	A	BBB	BB
Share of deal CN	-0.736*	***-1.235***	***-1.472***	-1.175*	***-0.661***
	(0.301)	(0.452)	(0.523)	(0.477)	(0.232)
Yield level	**0.215**	**0.300**	**0.275**	***0.147***	0.033
	(0.041)	(0.053)	(0.060)	(0.049)	(0.031)
Yield slope	**0.348**	**0.402**	**0.467**	**0.294**	**0.406**
	(0.035)	(0.057)	(0.046)	(0.044)	(0.028)
Ln deal volume	0.071	-0.060	**-0.246**	-0.096	-0.063
	(0.048)	(0.083)	(0.066)	(0.053)	(0.053)
Ln tranche volume	**-0.113**	-0.017	0.023	-0.016	-0.057*
	(0.012)	(0.039)	(0.042)	(0.022)	(0.027)
Share of deal FLP	0.957	1.542	1.327	2.290	0.254
	(0.556)	(1.556)	(1.094)	(1.164)	(1.383)
Credit enhancement	**-0.380**	0.195	-0.980	-1.648	-0.646
	(0.093)	(0.222)	(0.591)	(0.941)	(1.133)
Nb rating classes ex CN	0.014	-0.026	0.038	0.011	0.000
	(0.026)	(0.037)	(0.040)	(0.044)	(0.024)
LL dummy	**-0.147**	***-0.304***	-0.175*	-0.075	-0.087
	(0.042)	(0.095)	(0.072)	(0.058)	(0.046)
Sample size	234	128	120	127	104
Adjusted R^2	0.662	0.711	0.690	0.523	0.801
Prob > F	0.000	0.000	0.000	0.000	0.000
Clusters	123	119	116	120	102

securities the level of subordination is determined not exclusively by the rating, rating alone seems to capture subordination for lower rated tranches. The negative impact of the LL dummy on launch spreads is confirmed for AAA, AA, and A-rated securities.

When looking at the equity transfer proxy, results previously obtained in table 8 are confirmed. Coefficients are all negative and significant at 1% and 5%. Adding the WAL to the explanatory variables removes statistical significance from the coefficient on the share of deal CN for AAA rated securities, and increases the significance of the coefficient for BBB rated securities to the 1% level (not reported). The interpretation is as follows: the further subordinated a security, the higher the risk of being hit by defaults in the underlying asset pool. The positive quality signal hence gains importance for lower rated securities, while the effect on senior securities is limited. Economically, an increase of the relative aggregate CN volume by 0.01 implies a decrease of launch spreads in the range of 0.66-1.47%, as indicated by the coefficients in table 9 and in line with the results from table 8. However, the size of the coefficients is not steadily increasing with decreasing rating. Opposed to the analysis above, adding the share of deal CN variable to the analysis now increases adjusted R^2 noticeable. All regression were equally run without the equity transfer proxies (not reported). Adding the share of deal CN to the analysis increases adjusted R^2 going from AAA to BB by 0.9%, 1.6%, 2.4%, 3.1%, and 0.9%.

Overall, results indicate that the degree of equity transfer via the issuance of combination notes is observed by market participants and has a positive impact on pricing from the issuer's perspective as launch spreads decrease with rising equity transfer. However, credit ratings explain the large majority of variation in launch spreads, the observed equity transfer only has a minor impact.

5 Conclusion

This is the first empirical paper to focus on combination notes issued in securitization transactions. Several results are derived. Considering the descriptive statistics, the amount of overall equity transfer was estimated based on a subsample of the data where the exact combination note compositions are available: on average, about three combination notes are issued per deal, each containing a fraction of 8% deal equity. Together, this implies an equity transfer of 1.24 € billion of overall 4.9 € billion equity via combination notes for the 126 deals considered here. Also for the subsample, the rating of the combination notes is reconsidered: ratings assigned by the rating agencies are better than the value weighted averages of the single components' ratings. However, some of the assigned ratings are principal only ratings, and some ratings are assigned to a so-called rated balance only.

Tranching of combination notes is entirely driven by segmented demand for these securities. When focusing on the tranching decision within the combination notes of a deal, the aggregate volume of the combination notes in that deal is the predominant explanatory variable. When analyzing the tranching decision of combination notes on the deal level, no evidence can be found that tranching of combination notes reduces information asymmetries. Results on the benchmark case, the tranching decision among the plain vanilla tranches, are overall in line with existing literature, however weak in the statistical evidence due to the comparably small sample size. Furthermore, there is support that the market for combination notes of a single deal and therefore also equity of a single deal is limited in size, indicated by a negative relation of the overall deal volume and the relative size of combination notes per deal.

Further, equity transfer can be identified as driver for the issuance of combination notes, as the relative size of the combination notes in a deal increases the lower the quality of the deal. Moreover, equity transfer via combination notes is observed and accounted for by market participants: an impact of equity transfer proxied by combination note properties on launch spreads of plain vanilla tranches is detected. However, the predominant pricing factor for the securities considered here is the credit rating without refinements. The equity transfer information can explain variations in launch spreads when securities are grouped according to their rating, such that pricing factors beyond the credit rating are captured. This refined analysis reveals that observed equity transfer reduces launch spreads especially for securities not rated AAA, while the post issue liquidity effect associated with a larger tranche size and the credit enhancement only have an impact on the launch spreads of AAA rated securities. Further, there is some but weak support that the overall deal volume reduces launch spreads for mezzanine securities.

Besides the results described above, several aspects still deserve closer examination. On a descriptive level, a link between issuer sophistication and the issuance of combination notes was established. The analysis of this relation could be extended and generalized by integrating proxies for issuer reputation in the analysis of launch spreads. Also, results on the interest rate environment and its impact on launch spreads are mixed when compared to the literature on changes in bond spreads. Differences are possibly due to the specific characteristics of the underlying assets analyzed here, but merit closer examination. More generally, a comprehensive dataset on the issuance or retention of equity pieces in securitization transactions would allow several interesting research projects. However, the equity piece distribution is unknown even to regulators, and market participants are so far reluctant to release this confidential information.

Appendix

Table 10: Rating indices and rating agencies' letter grades.

Refined rating index	Rating index	S&P / Fitch	Moody's	Rating factor 10 years maturity
22	10	AAA	Aaa	1
21	9	AA+	Aa1	10
20	9	AA	Aa2	20
19	9	AA-	Aa3	40
18	8	A+	A1	70
17	8	A	A2	120
16	8	A-	A3	180
15	7	BBB+	Baa1	260
14	7	BBB	Baa2	360
13	7	BBB-	Baa3	610
12	6	BB+	Ba1	940
11	6	BB	Ba2	1350
10	6	BB-	Ba3	1766
9	5	B+	B1	2220
8	5	B	B2	2720
7	5	B-	B3	3490
6	4	CCC+	Caa1	4770
5	4	CCC	Caa2	6500
4	4	CCC-	Caa3	8070
3	3	CC	Ca	
2	2	C	C	
1	1	D	default	

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