Pan European ABS FRN Risk Model

We present the second-generation risk model for floating rate European asset-backed securities denominated in euros and sterling. The model continues the recent trend in Barclays Capital's credit risk modelling of relating risk to the level of spread and duration and replacing discrete rating levels as sources of risk. Empirical evidence presented here supports the existence of such a relationship for European ABS. The European ABS deals may be backed by a large variety of collateral types, and so in our model the risk-DTS relationship is allowed to vary across collateral types. Results for the market-wide benchmark index and for sub-indices by both collateral type and ratings suggest that our forecasts capture the level and evolution of their risk appropriately. The strength of our results is mitigated by the sample size, which starts in 2007, and is augmented with index data from 2004.

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INTRODUCTION[1]

The European ABS market suffered major transformations in the wake of the US subprime crisis. In the years before 2007, most of these securities were viewed as a safe harbour, with investment grade yield-enhancing bonds having spreads close to and sometimes tighter than Gilts and European government bonds. However, the market perception of the global ABS market has changed significantly. Although European ABS spreads have fallen substantially since the peak of the crisis, various sectors are still trading at distressed levels. Recent advances in risk modelling methods can be employed to appropriately address this sudden shift, and Barclays Capital has re-designed the Pan European ABS FRN risk model with these modelling advances in mind.

As a key innovation, the model follows the duration times spread (DTS) concept, whereby risk is a linear function of DTS. Since this asset class is backed by an eclectic mix of collateral, we create separate DTS factors for major collateral groups. From our experience with other asset classes, these tend to be the main driver of risk even in the presence of other factors. This is a move away from the previous methodology whereby the reported risk of a security is driven by the credit-rating bucket into which it falls.

We showcase the model behaviour for the Barclays Capital Pan European ABS FRN Index and several sub-indices. The results show that the time series behaviour of our risk forecast is as expected: risk increases as the financial crisis of 2007 strengthened and declines as the crisis subsided. The risk forecasts of sub-indices follow similar trends. At the sub-index level, the model captures well the differences in risk levels by collateral type (e.g., RMBS is typically less risky than CMBS) and by rating (AAA is less risky than BBB). The fact that the model can capture how European ABS risk changes with agency ratings without actually employing this characteristic is a testament to the DTS approach and its ability to capture the ratings-risk relationship.

The first section of this paper provides an overview of the European ABS market. The second describes the model and presents its behaviour, starting with the systematic part and following with the idiosyncratic. The section ends with an out-of-sample analysis of the model performance for various types of portfolios. Section 3 concludes.

[1] I would like to thank Antonio Silva and David Tattan for their contribution to the model, for valuable comments and suggestions. Yang Lu has been instrumental to the development of the model. Jozef Skvarcek contributed to the development and implementation of the risk model in POINT.

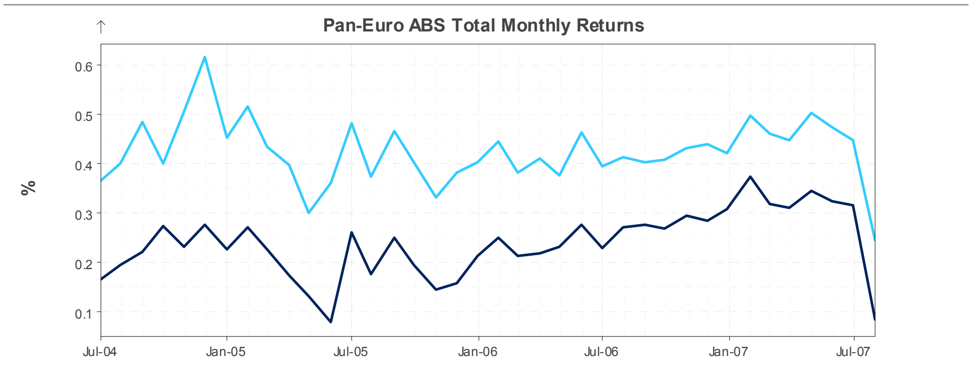
THE EUROPEAN ABS MARKET

The European ABS market developed in the late 1990s in the UK and Netherlands, initially adopting, and then adapting, structures that had been evolving in the US. Marking the growing importance of this asset class, a set of euro and sterling ABS benchmark indices was launched in 2004 and a suite of unifying Pan European ABS indices[2] was launched in February 2010. POINT has supported this asset class since 2007 (see Tattan (2007)).

The European ABS deals follow the same general principles of structuring established in the US,[3] whereby some securities are designed to absorb more of the potential losses and interest shortfalls of the underlying loans, while others are designed to be safer. Each security, or tranche, is targeted to a different type of investor, according to his or her risk preferences. Tranches are typically denominated in the currency in which the underlying loans are made, e.g., ABS backed by UK mortgages are denominated in sterling, while ABS backed by euro area loans are denominated in euros. However, this is not a hard rule: a significant number of securities are denominated in one currency, while the underlying loans are denominated in another. There are even a small number of securities backed by US collateral and denominated in euro or sterling to target European investors. In terms of coupon type, most tranches have been created as floating rate notes, with the coupon typically tied to the relevant swap market (Euribor for euro-denominated securities and Libor for sterling securities).

Before the subprime crisis, European ABS was considered a relatively safe investment, and higher-rated tranches traded extensively and were found in the portfolios of many global investors. The return behaviour of the Pan European ABS FRN index during 2007 and 2008 gives a good picture of how this perception changed. The local currency total monthly returns for the Barclays Capital Euro ABS FRN Index and Sterling ABS FRN Index – shown in Figure 1 – document that the historical volatility of total return was very small, up to July 2007.

Figure 1: Total Return of Barclays Capital Euro and Sterling ABS FRN Indices, 2004 to August 2007



Key	Axis	Name	Last	Minimum		Maximum		Mean	SD
	Left	Euro ABS FRN - Total Return	0.083	0.078	05/31/2005	0.373	01/31/2007	0.238	0.067
	Left	GBP ABS FRN - Total Return	0.245	0.245	07/31/2007	0.616	11/30/2004	0.424	0.064

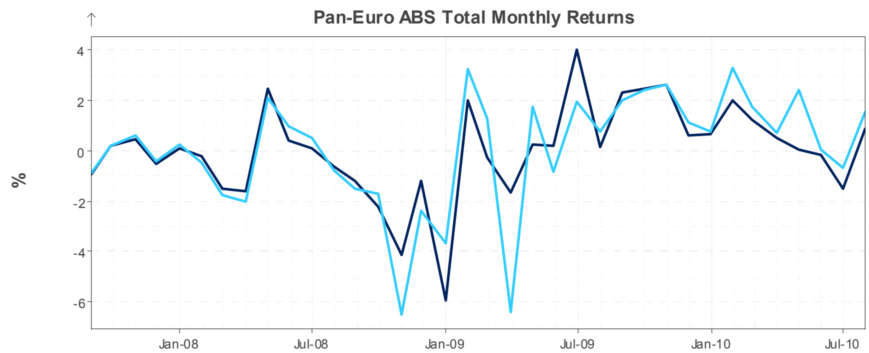
Source: Barclays Capital Live

[2] Please refer to Tattan, Myers et al. (2010) for more information. For these indices, the eligible asset classes include prime RMBS, buy-to-let RMBS, non-conforming RMBS, reverse RMBS, equity release RMBS, CMBS, credit card ABS, auto ABS, SME CLOs, student loan ABS, whole business securitizations, pub securitizations, water securitizations, consumer loan ABS, and lease ABS.

[3] For a description of the US ABS home equity and US CMBS markets, please refer to Gabudean (2009, 2010).

Although the crisis began as a tail event during the second half of 2007, it quickly transformed the European ABS into a highly volatile, credit-risk driven asset class. It traded closer to high yield credit and away from the previous perception of a low-risk high-yielding bond. Figure 2 shows that from 2008 onwards, total monthly return volatility has differed by orders of magnitude from pre-crisis levels: 1.86% vs. 0.07% for euro ABS and 2.27% vs. 0.06% for sterling ABS. These results mimic the behaviour of the US securitized (non-agency) market during the same period.

Figure 2: Total Return of Barclays Capital Euro and Sterling ABS FRN Indices, August 2007 to 2010



Key	Axis	Name	Last	Minimum		Maximum		Mean	SD
	Left	Euro ABS FRN - Total Return	0.873	-5.954	12/31/2008	4.026	06/30/2009	0.000	1.862
	Left	GBP ABS FRN - Total Return	1.551	-6.515	10/31/2008	3.272	01/29/2010	0.063	2.265

Source: Barclays Capital Live

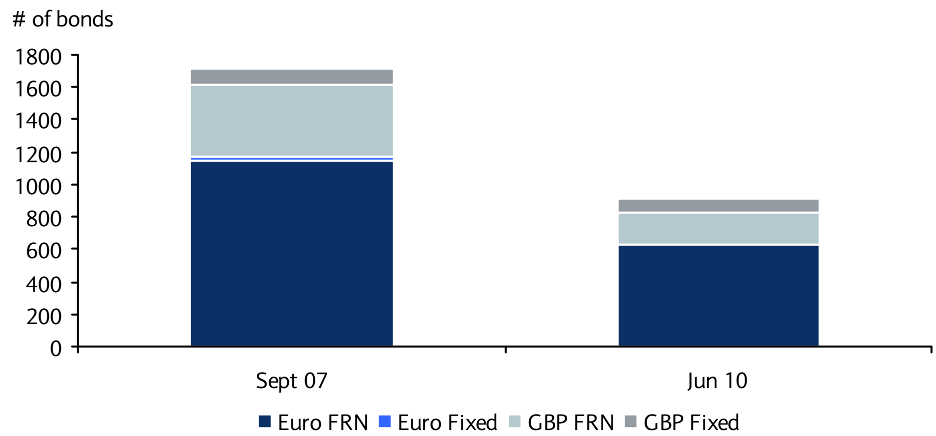
Data

In our analysis, we use a sample that starts when the data becomes available in POINT, October 2007, and comprises solely the bonds from Barclays Capital Euro ABS FRN and Sterling ABS FRN Indices (unified into the Pan European ABS FRN Index). We focus our new modelling efforts on ABS FRN securities and the fixed coupon ABS continue to be covered by our European credit risk model.[4]

Figure 3 reports the composition of the Barclays Capital Pan European ABS benchmark indices (that includes fixed coupon bonds). Initially, our sample was composed of 1,038 euro FRN bonds and 446 sterling FRN bonds. As of June 2010, our sample had fewer bonds, 625 euro FRN and 186 sterling FRN. This decrease was caused by bonds dropping out of the index due to very short WALs and lower amount outstanding. The small number of fixed coupon bonds (1% of the sample are euros fixed and 9% sterling fixed) justifies our focus on the FRN component of the market.

[4] Fixed-rate European ABSes have been part of the European Aggregate index since 1999. The constituent count in this index was generally small before 2004, at 10-30 securities.

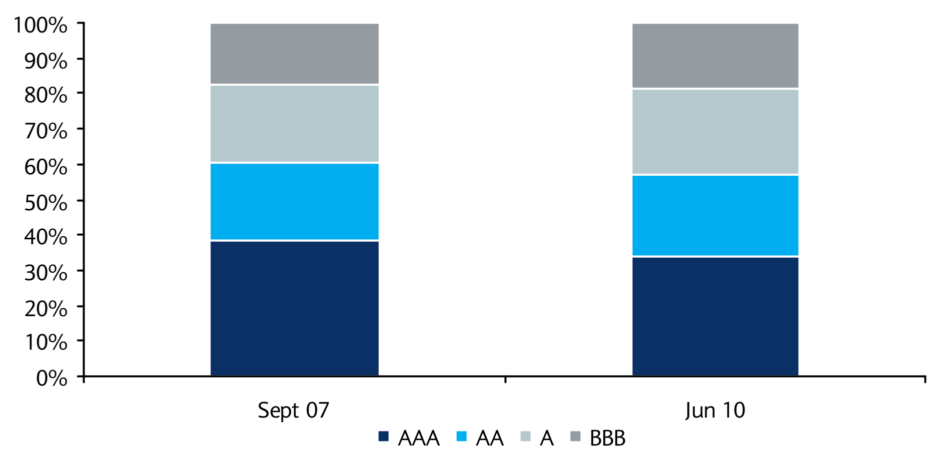
Figure 3: Combined Fixed and FRN Pan European ABS Indices: Size and Breakdown by Coupon Type and Currency



Source: Barclays Capital

The sample breakdown by ratings is relatively stable over time (Figure 4), with a third of the bonds rated AAA and the rest distributed almost evenly across the other investment grade buckets. In terms of collateral type (not shown), 60-70% of the sample is RMBS, and the rest is equally divided between CMBS and whole loans.

Figure 4: Calibration Sample Breakdown by Rating, Select Dates



Source: Barclays Capital

The analytics used in our risk model are based on a pricing model that does not account for defaults. During the crisis, heavy expected and realized credit losses have depressed prices. In our pricing model, this results in high spreads. Therefore, for modelling purposes, credit risk is fully embedded in spreads. This definition of spreads is widely used by market participants and drives the choice of systematic risk factors to explain the cross-sectional spread return. For prepayments, our models use a constant prepayment rate forecast for the remainder of the deal, thus ignoring the effect of future unexpected interest rate changes on prepayments.

THE PAN EUROPEAN ABS FRN RISK MODEL

The Systematic Risk Model

The Pan European Asset Backed Securities FRN Risk Model is part of Barclays Capital's Global Risk Model (GRM) and follows its general linear factor-based approach.[5] Returns are represented as a linear combination of systematic factors, with pre-defined loadings, plus a security-specific remainder (Figure 5). Factors embody various sources of common, or systematic, risk across all securities, such as curve and sector spread. Loadings give the risk exposure of each security to each risk factor. Factor risk models reduce the dimensionality of the problem of calculating the joint risk of all securities in a particular universe by focusing on a smaller subset of systematic risk factors. Lastly, we must model the security-specific risk of the remainder, which tends to be diversified away for large portfolios.

Figure 5: General Structure of a Factor Risk Model

$$R_{i,t+1} = \mu_{i,t} + L_{i,t} \cdot f_{t+1} + \varepsilon_{i,t+1}$$

$\mu_{i,t} =$ carry

$f_{t+1} =$ factor realization

$L_{i,t} =$ factor loading

$\varepsilon_{i,t+1} =$ remainder

Source: Barclays Capital

Systematic risk factors are grouped by types of risk: FX, curve, swap spread, and spread related (Figure 6). FX return exists only when our portfolio is in a different currency than the one in which the asset is denominated, which may happen for a diversified portfolio in this asset class. For yield curve factors, the model uses the GRM's factors corresponding to the bond's currency, either euro or sterling: six key rates (6m, 2y, 5y, 10y, 20y, and 30y) and one convexity. A bond's loadings to these factors are the option-adjusted key rate durations and the option-adjusted convexity of that particular bond. Swap spread factors receive a similar treatment.

Figure 6: Factor Breakdown

$$L_{i,t} \cdot f_{t+1} = R_{it}^{FX} + R_{it}^{YC} + R_{it}^{SS} + R_{it}^{Spread}$$

Source: Barclays Capital

Note that all fixed income securities in the same currency can potentially load on these first three sets of risk factors. In contrast, the remainder of the common risk across securities – spread risk – is modelled by spread factors specific to each asset class, in this case the European ABS FRN bonds; that is, only European ABS FRN securities have exposures to these specific spread factors. That said, these factors may be (and typically are) correlated with the curve factors or spread factors specific to other asset classes (e.g., credit). The choice of these factors and the construction of their loadings are the most complex parts of this new model and its main contribution.

[5] Please refer to Dynkin, Joneja et al. 2005 and the Portfolio Modeling Group research papers for more information.

Spread return R_{it}^{Spread} contains common sources of risk originating from either risk to future cash flows or risk to their discount factor. Treasury and swap curves affect both cash flows and discount factors; thus, the effect of any spread factor should be in addition to those, as curve effects are captured separately by the curve factors.

As mentioned, reference curves may change cash flows through prepayments and defaults. However, other factors may affect cash flows through prepayments or defaults. We forecast a constant rate of future prepayments, so the pricing model used to calculate the analytics available in POINT and to calibrate this risk model accounts for neither defaults nor unexpected prepayments, leaving all effects of these matters to be reflected in spread returns. These can be triggered by many factors, namely the dynamic of credit standards, underlying properties prices (e.g., residential or commercial mortgages, credit cards, autos), and the income they generate.

Similarly, the discount rate has a component additional to Treasury yields, which measures the level of risk aversion. Thus, default risk and risk aversion are captured by spread return. In fact, all other sources of risk are reflected there (e.g., liquidity). Because FRN cash flows (coupons) and discount factors adjust with interest rates, the spread return, our main focus, is typically close to the total local currency return less carry.

Defaults

The notion of default for this asset class is different and more complex from its meaning in the corporate bond market. There are two notions of default for ABS bonds: of the underlying loans and of the ABS. The two measures are intertwined: as underlying loans default, it is less likely that ABS investors will recover their money. The underlying loan group may experience a “default event” that triggers changes in the cash flow allocations among ABS tranches, but does not necessarily lead to liquidation of any security. Some default events may affect only some securities in a deal. Even when a security stops paying interest and/or principal, it may start paying again if the performance of underlying loans improves. Moreover, a missed payment is not always a default event. Thus, default is less clear-cut than it is in the corporate world. Given these characteristics, we do not model default risk separately; we lump it into spread risk.

It is difficult to disentangle how much of the spread risk originates from each of the sources mentioned: default risk, pre-payment uncertainty or risk aversion. In the Pan European ABS FRN Risk Model, we treat these risk sources jointly. When researching specific risk factors, we look for variables that may account for one or more of these risk sources.

The Relation between DTS and Spread Return Risk: Empirical Evidence

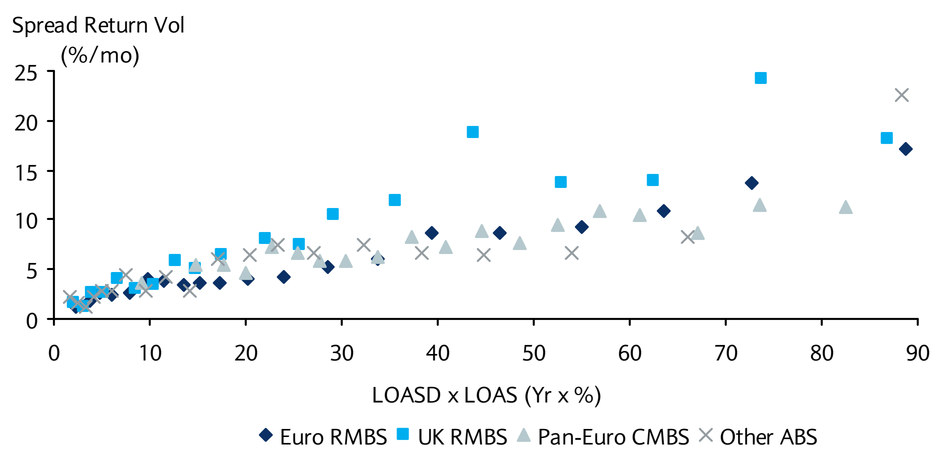
Recent research (e.g., Dor, Dynkin et al. (2005)) suggests that volatility of a particular bond can be well forecasted by the bond’s duration times its spread (DTS). Specifically, it seems that spread levels are a good predictor of near-term spread volatility, with a linear relationship between current spread levels and future spread volatilities. These findings make it attractive to model spread changes as a log-normal process, rendering their estimation and forecasting more robust across different market conditions. Further research suggests that this result also applies to other assets classes. In POINT, this approach is already available in risk models for several asset classes[6]. It is therefore natural to investigate whether DTS is also a relevant concept for European ABS.

[6] See Silva (2009a) for a description of the implementation of DTS in POINT’s credit risk model, Silva (2009b) for emerging markets and Gabudean (2009, 2010) for an implementation in the ABS Home Equity and CMBS risk models. Gabudean (2010) presents more details of the typical research to model the risk-DTS relationship for securitized.

For the European ABS market, higher spreads are related, for instance to higher risk aversion or higher market expectations of default losses. All these effects are commonly associated with higher volatility and are compounded by the spread duration of the bond: all else equal, the more distant the cash flows, the larger the effects. It is this intuition that gives DTS its appeal.

Our universe contains a diverse set of securities, backed by different loans from different markets that may behave differently. To investigate the empirical relationship between risk and DTS, we group the securities into four buckets based on the underlying collateral: European RMBS, UK RMBS, Pan European (including UK) CMBS, and Other Pan European ABS (non-mortgage backed). We opt for such a coarse grouping given our small sample size, especially on the time series dimension. This limitation follows us throughout the empirical analysis. Then, for each group, each month we sort the universe by the beginning-of-the-month DTS into 20 equal-weighted portfolios. Thus, securities with DTS in the 0-5 percentile fall into portfolio 1, bonds with DTS in 5-10 percentiles in portfolio 2, etc. For each portfolio, we compute its spread return (i.e., total return less carry and returns attributable to changes in Treasury curve and swap spreads) over the month. This return should be mostly systematic, given that each portfolio is relatively large, with a minimum of 10 and typically with 20 bonds. Repeating the exercise every month, we obtain for each collateral type 20 time series of returns and beginning-of-the-month DTS values. For each of these time series, we compute from October 2007 to July 2010 the unweighted return volatility and the mean DTS. We present these results by collateral type in Figure 7, showing average DTS on the horizontal axis and the volatility of spread returns on the vertical.

Figure 7: Relation between Volatility of Spread Return and DTS, By 20 DTS-Sorted Portfolios and Collateral Type, From Oct 2007 to July 2010



Source: Barclays Capital

We can see the quasi-linear relation between volatility and average DTS for all four collateral types. The magnitude of the slope, between 0.16 and 0.21, is comparable to the one found for corporate bonds (in general 0.1, but higher during the financial crisis) and other securities.

Note that there is a variation in the slope across collateral types, validating the choice to separate the analysis by collateral type. The time series correlations among the four groups are 60-80%, significantly less than one, suggesting a diverse set of behavior across groups.

This evidence seems to suggest that there is a strong linear relation between the spread return risk and DTS for this market and that it varies by collateral type.

The Relation between DTS and Spread Return Risk: Forecasting

To formalize the relationship between DTS and spread returns, we can start with the following expression:

$$R_i^{Sprd} \approx -OASD_i * \Delta LOAS_i = OASD_i \times LOAS_i \times \frac{-\Delta LOAS_i}{LOAS_i}$$

$$= DTS_i \times F^{DTS}$$

where F^{DTS} is the risk factor realization associated with the DTS and can be interpreted as the negative percentage change in LOAS. Although powerful, there are several limitations to this specification, so we introduce additional features in the model to circumvent them. One such refinement is to recognize that for very low level of spreads (as shown in Figure 7), the relationship between risk and spreads may not follow the same linear function as for the rest of the securities. For example, a security with a 5bp LOAS is unlikely to have half the spread risk of a security with 10bp LOAS. Moreover, for bonds with negative spreads, DTS is ill-defined. Therefore, we must set a base level of risk (lower bound on volatility) to be assigned to all bonds, independently of their DTS level. In many other risk models we considered a separate risk factor to model this base volatility. Here, given our data limitations, we opt instead for a more parsimonious specification. Specifically, we set a minimum level for the DTS, given by:

$$DTS_i^* = \underline{LOAS}_i \times \underline{OASD}_i$$

where $\underline{LOAS}_i = \max(LOAS_i, 0.75\%)$ and $\underline{OASD}_i = \max(LOASD_i, 1year)$

Therefore, all bonds will have a minimum loading on DTS of 0.75%. Moreover, for very high levels of DTS, the relation between risk and spread is weaker. This can be seen in Figure 7 and is consistent with the results from other asset classes. Therefore, we cap the DTS at 100% and define

$$DTS_i^{Adj} = \min(DTS^*, 100\%).$$

For risk purposes therefore, the spread return becomes $R_i^{Sprd} \approx DTS_i^{Adj} \times F^{DTS}$.

A similar specification for DTS has been employed by Silva (2009b) to model the risk of emerging-market securities.

For this empirical analysis we separated the sample into four collateral groups and then each group into 20 sub-groups. However, for the estimation of the actual risk factors we do not need this second step. Therefore we can afford a more detailed partition of the Pan European ABS universe across collateral groups. Specifically, we calibrate a separate DTS factor for each of the following:

- Dutch RMBS
- Italian RMBS
- Spanish RMBS
- UK Prime RMBS
- UK Non-conforming RMBS
- Other Pan European RMBS
- Non-UK European CMBS

- UK CMBS
- Other Pan European ABS

Other Risk Factors

Our research shows that even after controlling for collateral-type and DTS, risk still differs depending on the currency of denomination. Specifically, there is a difference in the volatility profile of residual returns (after subtracting the effect of DTS) for a portfolio containing only sterling issues versus a portfolio that contains only euro issues. For instance, the sterling portfolio has volatility over the sample period of 79bp/month, while the euro portfolio has a volatility of 35bp/month. Moreover, their correlation is only 36%, signalling different behaviors. In our model we capture this difference by incorporating a sterling-specific “dummy” factor in our model. The loading is defined as:

- OASD x $1_{\text{Currency="GBP"}}$.

With this addition, the final form of the factor model for systematic spread return for security *i* belonging to collateral group *J* is given by:

$$R_i^{Sprd} = DTS_i^{Adj} \times F^{DTS,J} + OASD_i 1_{Currency=GBP} \times F^{IsGBP}$$

We estimate this model using a robust regression method that consists of an iterative process whereby the model is estimated with a given set of weights for each observation, then observations with large residuals are down-weighted and the model re-estimated. The procedure stops when parameters become stable across steps.

In-Sample Analysis

In Figure 8 we report the R-squared of the model (first row). Its value is 27% on average across the 34 months of our sample. This number is comparable with those seen for other distressed assets, so it is not surprising, given the historically unstable period we are analyzing. In terms of individual factors, all DTS factors are strongly statistically significant for most periods (not shown). The “isGBP” factor is statistically significant for more than three quarters of our sample months. Lastly, the robust regression method retains on average 72% of our sample (second row in Figure 8).

Figure 8: Average over Time of Estimation Metrics

Metric	Average
R-squared	**27%**
Average observation weight	72%

Source: Barclays Capital

The Idiosyncratic Risk Model

Not captured in systematic component is the risk corresponding to the residual, name-specific, or idiosyncratic return (the reminder from Figure 5). By definition, this risk is uncorrelated across securities and with systematic risk. We model the idiosyncratic risk assuming it is also a function of DTS. The justification for the relationship between idiosyncratic risk and DTS is similar to the systematic case: higher spread securities have higher idiosyncratic prepayment risk or default risk. This approach is widely used in other credit models and provides an almost constant proportion between idiosyncratic and systematic risk, something we found to be the case empirically. We impose on the DTS used for idiosyncratic risk the restrictions used in the systematic model. The only difference is that, for parsimony, we do not allow the DTS factor to vary by collateral. This means that we have only one estimated parameter for the idiosyncratic model. The equation of the idiosyncratic model is

$$Vol\left(\varepsilon_{i,t+1}\right) = DTS_{i,t}^{Adj}\sqrt{P^{DTS}}$$

Each month, we estimate the idiosyncratic parameter *P* from the squared residual return after the estimation of the systematic model. To forecast the idiosyncratic risk over the next month, we average the parameters over their history and use those averages in conjunction with the formula above. To provide a sense of the magnitude of idiosyncratic risk, Figure 9 shows the average loadings and the square root of the time-weighted average parameter as of July 2010. Column three, the product of the first two columns, shows the idiosyncratic risk for a typical bond. The total risk at 4.63% per month is high, owing to a large value for the loading (approximately equivalent to a LOAS of 400bp for a 5y OASD bond) and a large value of the DTS parameter.

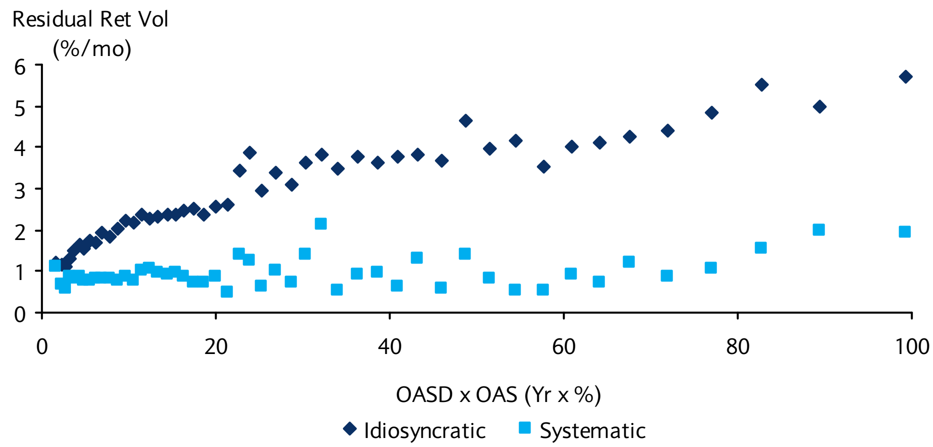
Figure 9: Typical Bond's Idiosyncratic Risk, July 2010

	Sq Root Param Mean	Avg Loading	Risk %/month
DTS	0.24	19.3	4.63

Source: Barclays Capital

To produce empirical evidence for the relationship between DTS and idiosyncratic volatility, we rely on a similar investigation as done for systematic risk. Each month, we sort the universe into 50 groups based on the beginning-of-the-month DTS. Within each group, we compute across all bonds the average squared residual return after estimating the systematic model. This quantity represents the typical non-systematic variance during that month for that particular DTS group. Next, we average over time for each group this monthly non-systematic variance. The square root of this quantity should be the idiosyncratic risk over the period of a typical security belonging to that DTS group. If idiosyncratic risk is linearly related to DTS, then this quantity should increase across groups linearly with the average group DTS. The dark dots in Figure 10 show that volatility is indeed linear in the DTS level. Their slope, at .07, is in line with other models' DTS-risk relationship.

Figure 10: Idiosyncratic and Systematic Risk of Residual Returns within Each of 50 DTS-Sorted Groups, October 2007-July 2010



Source: Barclays Capital

We further test one of the assumptions made in the previous exercise: that the residuals left over from the systematic model contain mainly residual risk. To see whether this is the case, for each of the DTS groups above, we compute for each month the average residual return, which gives a measure of the systematic component left in these returns. Next, we take the standard deviation over time of this measure for each group and plot it against the average DTS of the group. The results are added to Figure 10. We see that there is almost no relation between this measure of systematic risk in residual returns and DTS, showing that we hedged the DTS risk well in our long-short DTS-matched portfolios. Moreover, the measure capturing mainly systematic risk is much smaller than the one designed to capture idiosyncratic risk. This seems to validate our previous analysis of idiosyncratic risk.

How does one interpret the presence of a similar factor in both systematic and idiosyncratic risk models? The systematic DTS captures the fact that high DTS bonds go up or down at the same time and by a greater magnitude than low DTS bonds. The idiosyncratic DTS expresses the intuition that the individual returns of high DTS bonds may deviate more from the average return of high DTS bonds than the individual returns of low DTS bonds may deviate from their average return. One factor relates the means of the return distributions of high and low DTS bonds; the other relates their standard deviations.

Risk Forecasting

In this section, we detail the characteristics of the risk predictions from our new model. The summary statistics of the risk factors realizations are shown in Figure 11 from October 2007 to July 2010. The standard deviation of the DTS factors is in a range consistent with other asset classes: 0.13-0.24. The factors have a mean close to 0 and exhibit left skewness. The isGBP factor has a standard deviation of 0.32, which is comparable to the volatility generated by DTS factors for a bond with LOAS of 200bp. This factor has a mean of zero as well, but no skewness.

To assess the risk contribution from each factor better, we add to the analysis the magnitude of the risk factors' loadings. In Figure 12, we show as of July 2010 the time-weighted volatility of each factor, its loading size, and the product of the two. The loading size is that of a typical bond that loads on that factor; e.g., for DTS Spanish RMBS, we show the median DTS across all Spanish RMBS bonds.

Figure 11: Factors Summary Statistics

Variable	Units	N	Mean	Std Dev	50 Pct	10 Pct	90 Pct
DTS Dutch RMBS	1/(m*y)	34	-0.04	0.24	0.00	-0.34	0.17
DTS Italian RMBS	1/(m*y)	34	-0.02	0.24	0.00	-0.25	0.12
DTS Spanish RMBS	1/(m*y)	34	-0.07	0.16	-0.01	-0.32	0.06
DTS UK Prime RMBS	1/(m*y)	34	-0.01	0.20	0.02	-0.22	0.20
DTS UK Non-conforming RMBS	1/(m*y)	34	-0.07	0.21	0.00	-0.38	0.08
DTS Other RMBS	1/(m*y)	34	-0.04	0.15	-0.01	-0.27	0.09
DTS Euro CMBS	1/(m*y)	34	-0.07	0.17	-0.01	-0.32	0.07
DTS UK CMBS	1/(m*y)	34	-0.08	0.20	0.00	-0.27	0.03
DTS Other ABS	1/(m*y)	34	-0.03	0.13	0.00	-0.08	0.04
Is GBP	%/(m*y)	34	-0.06	0.32	-0.06	-0.23	0.22

Source: Barclays Capital

As noted above, DTS factors' volatility is relatively similar across collateral groups. However, the typical loading varies significantly with collateral groups. For example, the RMBS bonds have a typical loading in the single digits, generating a risk of 2-2.5%/m. The exceptions are Spanish RMBS (3.8%/m risk) and UK Non-Conforming (14%/m). These results are expected, given the particularly severe downturn experienced by the Spanish economy and the fact that non-conforming mortgages experienced more uncertainty when compared with conforming ones. Non-conforming does often (but not always) include subprime mortgages.

At 8-9%/m, the CMBS bonds have higher risk than RMBS, a direct effect of the upheaval in the sector. Other ABS has a risk similar to prime RMBS, at 3.1%/m, and it includes credit card, auto, and other consumer loans. The magnitude of systematic risk is comparable with idiosyncratic risk (typically 4.63%/m, as seen in Figure 12), particularly for riskier types, such as CMBS. The last factor, IsGBP, generates much lower risk than the DTS ones, yet still significant at 0.8%/m.

Figure 12: Risk of Each Factor and Correlation of Relevant Factors with IsGBP Factor

	Std Dev	Loading Size	Risk %/m	Correl w/ IsGBP
DTS Dutch RMBS	0.30	7.6	2.3	35%
DTS Italian RMBS	0.31	6.7	2.0	24%
DTS Spanish RMBS	0.22	17.7	3.8	44%
DTS UK Prime RMBS	0.27	9.5	2.5	33%
DTS UK Non-conforming RMBS	0.27	52.7	14.0	58%
DTS Other RMBS	0.21	27.4	5.7	40%
DTS Euro CMBS	0.21	44.1	9.4	46%
DTS UK CMBS	0.24	35.2	8.6	40%
DTS Other ABS	0.17	18.1	3.1	64%
IsGBP	0.30	2.7	0.8	100%

Source: Barclays Capital

Since a bond can load only on one of the DTS factors, the risk portrayed in Figure 12 is the total systematic risk of a typical bond. The exception is for securities denominated in GBP. For those, the total risk comes from both their DTS factor and the IsGBP factor, as explained above. The last column of Figure 12 shows the correlation of DTS factors with IsGBP. It is positive, but not very high. Thus, sterling ABS securities may have a higher systematic risk forecast than what is implied by their corresponding DTS factor. However, given the low volatility of the IsGBP factor, DTS is still typically the main driver of risk, especially for intermediate and high DTS-level bonds.

Correlations among DTS factors contribute significantly to the risk of Pan European ABS portfolios. To understand how much diversification portfolio managers can get across various types of Pan European ABS, we present in Figure 13 the correlation among DTS factors as of July 2010.

All correlations are above 60%, with many above 80% (in bold), suggesting that it is difficult to diversify significantly within this asset class. In particular, UK CMBS and Pan European CMBS have a 96% correlation. Italian RMBS is the least correlated asset type, offering the most diversification. UK asset classes have a weaker correlation among themselves than others do, with levels of 73-78%. These high correlations are the result of the crisis that hit this sector in 2007 and 2008. They may be expected to decrease as the asset class enters a lower volatility regime.

Figure 13: Time-Weighted Factor Correlations, July 2010

	Dutch	Italian	Spanish	UK Prime	UK Non-conf	Other	Euro CMBS	UK CMBS	Other ABS
Dutch RMBS	1.00	0.69	**0.87**	**0.89**	0.75	**0.94**	**0.89**	**0.84**	0.68
Italian RMBS	0.69	1.00	0.78	0.68	0.63	0.68	0.76	0.74	0.62
Spanish RMBS	**0.87**	0.78	1.00	**0.85**	**0.80**	**0.86**	**0.90**	**0.84**	**0.80**
UK Prime RMBS	**0.89**	0.68	**0.85**	1.00	0.75	**0.91**	**0.82**	0.78	0.74
UK Non-conforming RMBS	0.75	0.63	**0.80**	0.75	1.00	**0.82**	0.79	0.73	**0.86**
Other RMBS	**0.94**	0.68	**0.86**	**0.91**	**0.82**	1.00	**0.89**	**0.82**	0.79
Euro CMBS	**0.89**	0.76	**0.90**	**0.82**	0.79	**0.89**	1.00	**0.96**	0.78
UK CMBS	**0.84**	0.74	**0.84**	0.78	0.73	**0.82**	**0.96**	1.00	0.74
Other ABS	0.68	0.62	**0.80**	0.74	**0.86**	0.79	0.78	0.74	1.00

Source: Barclays Capital

To conclude the risk analysis, we look at the typical correlation between the European ABS factors and factors from other asset classes. The results in Figure 14 show that Euro ABS factors correlate weakly with curve factors, albeit not in a consistent fashion: a negative correlation with the euro-level factor and a positive one with the GBP level factor. The correlation with other DTS factors, either similar geographically or by asset class type, are typically significantly positive at 43-48%.

Figure 14: Time-Weighted Factor Correlations with Other Asset Classes, July 2010

	Pan Euro ABS DTS
Euro Curve Level	-29%
Euro Curve Slope	29%
GBP Curve Level	34%
GBP Curve Slope	-10%
Euro Credit UHG	8%
Euro Credit DTS	**45%**
GBP Credit UHG	9%
GBP Credit DTS	**48%**
US ABS Home Eq DTS	21%
US CMBS DTS	**43%**

Source: Barclays Capital

Portfolio Back-Testing

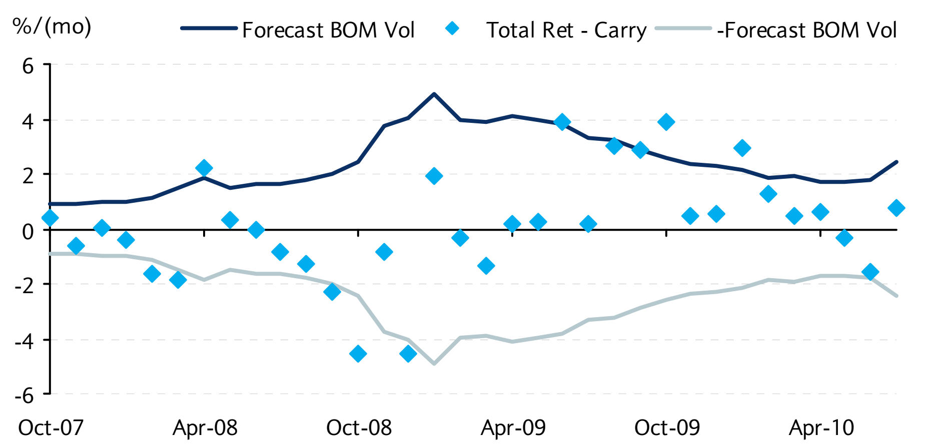
Given our limited time series sample – starting in 2007 – we cannot perform significant out-of-sample back-tests[7]. Instead, we limit ourselves to presenting the forecast volatility[8] of several components of the Barclays Capital Pan European ABS FRN Index and contrast them with their carry-adjusted total return in local currency[9]. If the model performs well, the standard deviation of the ratio of return to forecasted volatility should be about 1.

The Benchmark Index

To study the systematic spread return volatility model, we start with the most diversified index covering this asset class: Barclays Capital Pan European ABS FRN Index. Figure 15 plots the time series of the index's total return less carry and the model's forecasted volatility at the beginning of each month (both as a positive and a negative value). Note that curve risk is insignificant for FRN bonds; thus, total return is almost equivalent to spread return.

Results show that the model captures return volatility well. Coming into the crisis, it forecasts low volatility levels, at about 1%/month, in line with return realizations. Once the crisis is in earnest, volatility picks up, reaching more than 4%/month within a year of the lows. Then forecasted volatility gradually decreases to a post-crisis level of about 2%/month. Again, the forecasts are in line with observed returns. Once markets become more volatile in the spring of 2010, because of the European sovereign debt worries, forecast volatility picks up again.

Figure 15: Time Series of Carry-Adjusted Total Returns and Predicted Volatility for the Pan European ABS FRN Index, October 2007-July 2010



Source: Barclays Capital

[7] Gabudean (2010) details a more extensive back-testing of a DTS-based risk model for a securitized asset-class.
[8] We create our initial risk forecast as of October 2007 from the past behaviour of the Pan Euro ABS FRN Index sub-components.
[9] Total returns are adjusted for carry by subtracting their LOAS/12. For the carry calculation, we cap the LOAS at 5%. This assumes that investors do not expect more than 5% in annual carry, roughly the historical size of the equity premium. Any OAS exceeding that number can be seen as adjustment for potential principal losses not captured by the pricing model.

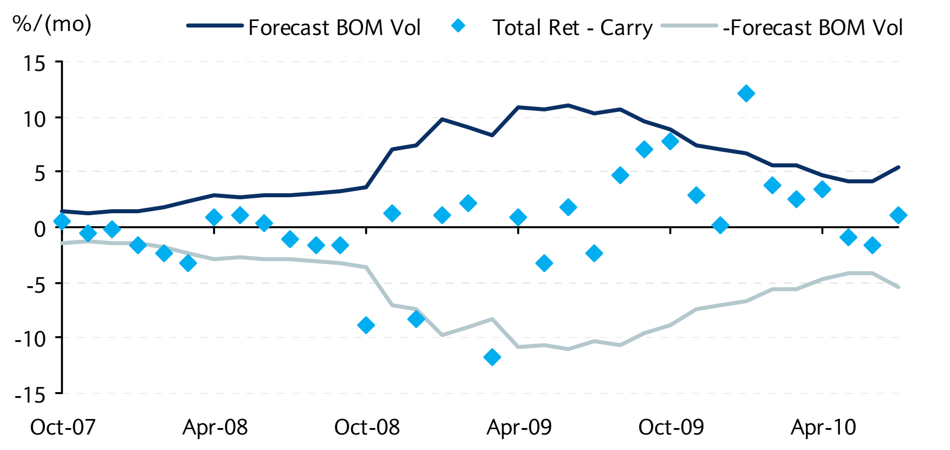
Sub-indices

Capturing the risk appropriately of the entire market is a requirement of a good risk model, but not sufficient. Our model should be able to capture the risk of various specialized portfolios as well. To understand its behavior along this dimension, we look at how well we forecast the risk of various sub-indices, constructed along collateral type or bond quality.

We start by looking at sub-indices defined by collateral type. We follow roughly the categories investigated in Figure 7, where we documented the relation between DTS and risk: CMBS, Euro RMBS, and UK RMBS. We do not look at the last category because it is a catch-all one and it cannot be linked intuitively with a sub-index. Further down, we will look at indices that include some of the non-CMBS or RMBS instruments, such as the Pan Euro ABS FRN AAA Index.

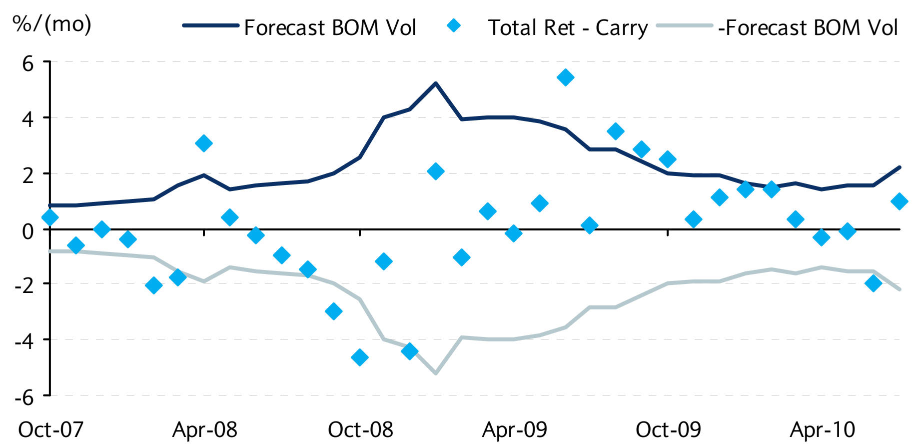
The first type we investigate is CMBS: in Figure 16, we plot the results for the Pan European FRN CMBS Index. We note a similar time series pattern with the main index in Figure 15, with low volatility before the crisis, very high in the middle of it and lower again recently. The next collateral types, European RMBS (excluding UK) and UK RMBS are shown in Figure 17 and Figure 18. While results are qualitatively similar to the ones for CMBS, they differ on the overall level of risk. RMBS risk is smaller than for CMBS: The latter's forecasted volatility peaks above 10%/month during the summer of 2009, with some observed total returns in that range; the former's risk forecast peaks at 5%/month, with actual returns not significantly higher than that. Comparing the two RMBS indices, we note that the UK has higher risk for longer periods, due in part to the slower recovery from the crisis of UK assets when compared with European ones. Thus, our risk model captures well the different risk levels associated with the different collateral types.

Figure 16: Time Series of Carry-Adjusted Total Returns and Predicted Volatility for the Pan Euro CMBS FRN Index, October 2007-July 2010



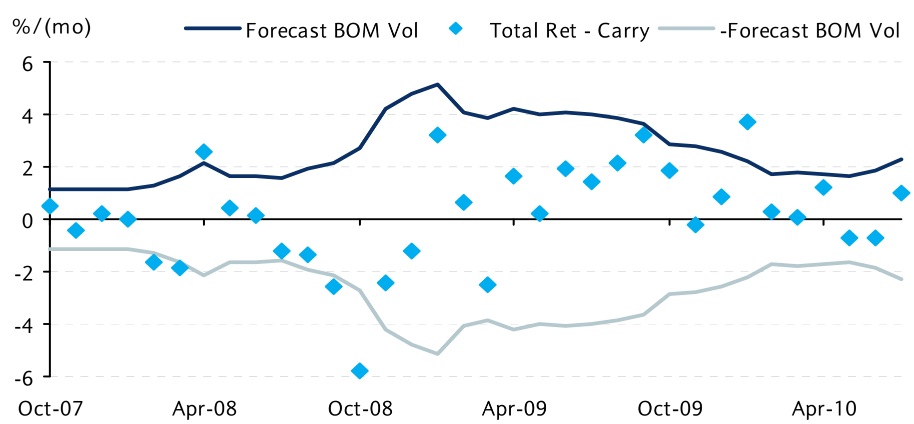
Source: Barclays Capital

Figure 17: Time Series of Carry-Adjusted Total Returns and Predicted Volatility for the Euro RMBS FRN Index, October 2007-July 2010



Source: Barclays Capital

Figure 18: Time Series of Carry-Adjusted Total Returns and Predicted Volatility for the UK RMBS FRN Index, October 2007-July 2010

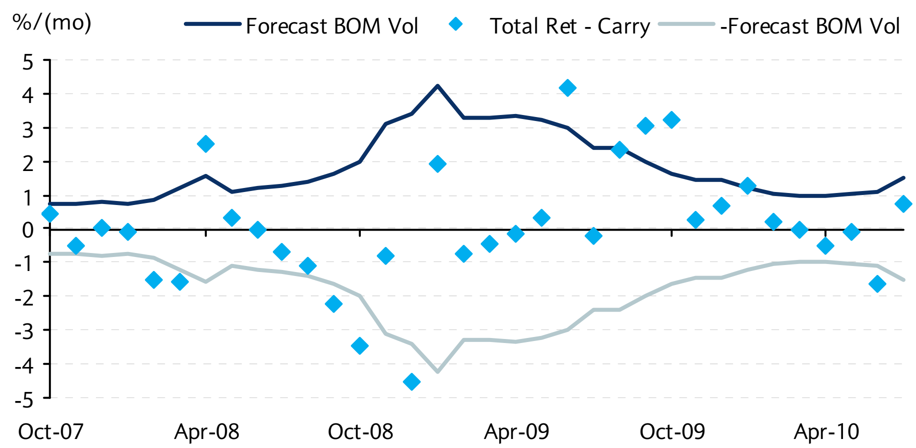


Source: Barclays Capital

Next, we look at how the model captures risk for ratings-based indices. This is an important exercise, since our model does not include ratings-based factors. Moreover, a major claim of DTS is that it can capture well the difference in risk for bonds with different ratings without relying directly on them. In Figure 19 and Figure 20, we show the results for the Euro ABS AAA and Euro ABS BBB indices. Individually, we forecast the index risk well, as is the case with the previously shown indices. But the risk and return of the two indices are significantly different.

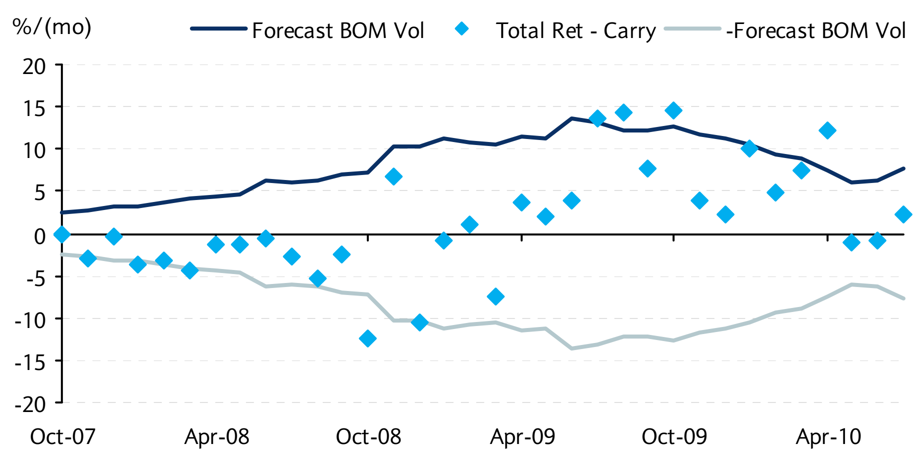
The BBB index has much larger volatility, starting at 2.6%/month in 2007 and peaking at 13%/month during 2009. For the AAA index, volatility starts at 0.7%/month and reaches its highest point at 3%/month. Moreover, BBB risk stays high longer, coming below 10%/month only in 2010, while the risk of the AAA index is 1.5%/month – half the peak levels – by fall 2009. The difference in risk forecast is supported by the actual total returns: the BBB index experiences returns about 15%/month during the second half of 2009-early 2010, but the AAA index does not experience a monthly return larger than 2% in absolute value after October 2009. Thus, our risk model captures the different risk behavior of ratings-based indices well.

Figure 19: Time Series of Carry-Adjusted Total Returns and Predicted Volatility for the Euro ABS AAA FRN Index, October 2007-July 2010



Source: Barclays Capital

Figure 20: Time Series of Carry-Adjusted Total Returns and Predicted Volatility for the Euro ABS BBB FRN Index. October 2007-July 2010



Source: Barclays Capital

To summarize the graphs above, we show in Figure 21 the summary statistics of the ratio of total returns to forecasted volatility. We expect a mean of 0, a standard deviation of 1, and a minimum and maximum of similar magnitude. Given that we have 34 observations, we expect the magnitude of the extreme values to be about 2, if the distribution of our ratio is close to normal. Looking at the results, most indices have a ratio of returns to forecasted risk centred close to zero, with standard deviations between 0.76 and 0.95, which suggests some overestimation of risk. Note that given the small sample, we cannot rule out statistically that the forecast is unbiased in this sense. Lastly, the magnitude of the extreme values is mainly between 1.65 and 2, close to the expected values. We note that the negative values are larger in magnitude than the positive ones, except for ratings-based indices, showing some left skewness in the distribution. This is an expected result of the fact that the financial crisis dominates our small sample.

Figure 21: Summary Statistics of the Ratio of Carry-Adjusted Total Return to Forecasted Volatility, for Various Indices

Index	N	Mean	Std Dev	Min	Max
Pan Euro	34	-0.02	0.82	-1.88	1.50
Pan Euro CMBS	34	-0.10	0.81	-2.44	1.79
Euro RMBS	34	-0.02	0.92	-1.97	1.61
UK RMBS	34	-0.01	0.76	-2.14	1.68
Euro ABS AAA	34	-0.03	0.95	-1.79	1.97
Euro ABS BBB	34	0.00	0.78	-1.72	1.65

Source: Barclays Capital

From the evidence presented in this section, we conclude that our model captures risk well in several dimensions: in time series, across collateral types, and across ratings.

Access in POINT

The new Pan European ABS FRN risk model is implemented in POINT – the flagship Barclays Capital portfolio analytics and risk management platform – as part of the Global Risk Model (GRM). The risk report package in POINT delivers a very detailed view of the different sources of risk. For more details on GRM and its reports, please refer to Joneja, Dynkin et al. (2005). Below, we focus on only two reports from the report package: the risk summary report and the factor exposure report.

In Figure 22, we present the top of the risk report first page, the "Portfolio Risk Summary Report." It shows the risk of the Barclays Capital Pan European ABS FRN Index vs. cash, on July 30, 2010, using the euro as the base currency. The new risk factors are captured under the "Spread Securitized" group in the factor partition. The "TEV Summary" in the top-right corner shows that the total risk of the index is 277.3bp/month, with 275.9 coming from the systematic factors and 27.7 from idiosyncratic. As discussed, we do not treat defaults separately for this asset class, so the risk associated with explicit defaults is zero. Moreover, the "Factor Partition Summary" panel in the figure shows that, as of the report date and for this index, the "Spread Securitized" systematic factor group overwhelmed the "FX" factor group in what concerns the contribution to the total risk of the portfolio. The other two factor groups, namely "Curve" and "Swap Spreads," show a risk close to zero.

Figure 22: Partial View of the "Portfolio Risk Summary Report" of POINT Risk Report for the Barclays Capital Pan European ABS FRN vs. Euro Cash, on July 31, 2010

POINT® Global Risk Model

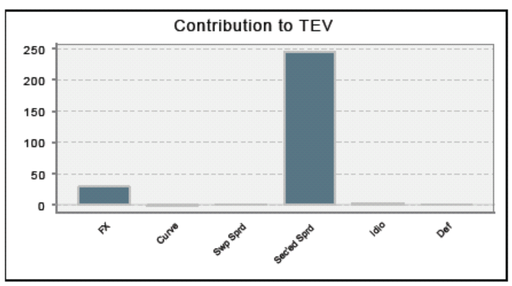
Portfolio Risk Summary Report

Portfolio: Pan Euro ABS FRN Index (Statistics)
Index: EUR Cash
Reporting Units: Returns in bps/month

Run Date: 10/15/2010
As of Date: 7/30/2010
Base Currency: EUR

Factor Partition Summary

	Contrib to TEV	Isolated TEV	Systematic Beta
Total	277.3	277.3	0.0
Systematic	274.5	275.9	0.0
Foreign Exchange	29.6	76.5	0.0
Curve	-0.1	0.8	0.0
Swap Spreads	0.0	0.4	0.0
Spread Securitized	245.0	256.1	0.0
Idiosyncratic	2.8	27.7	-
Credit default	0.0	0.0	-



TEV Summary	
Total TEV	277.3
Systematic TEV	275.9
Idiosyncratic TEV	27.7
Default TEV	0.0

Portfolio Info	
Last Transaction	N/A
Total MV (MM$)	258.1
Cash MV (MM$)	0.0
Total Notional (MM$)	302.5
Positions Included	792
Positions Excluded	2

Source: POINT, Barclays Capital

In Figure 23, we show a snapshot of the "Risk Factor – Full Detail" section of the same report package. We re-run the same risk report, but now implicitly hedging the "Currency", "Yield Curve", "Swap Spreads" and "Volatility" factor groups. In this setting, the model picks up only factors specific to European ABS FRNs. The section presents the set of systematic factors on which the portfolio and benchmark loads. For each factor, the report shows the nature of the exposure, its value for the portfolio, benchmark and net position, its volatility, and several risk analytics associated with each factor. As described above, these together with yield curve, swap spread and FX factors are the systematic factors on which one should expect a Pan European ABS FRN portfolio to load.

Figure 23: The "Factor Exposure – Full Details" of POINT Risk Report for the Barclays Capital Pan European ABS FRN vs. Euro Cash, Implicitly Hedging "Currency", "Yield Curve", "Swap Spreads" and "Volatility" Factor Groups, on July 31, 2010

Factor name	Sensitivity/Exposure	Portfolio exposure	Benchmark exposure	Net exposure	Factor volatility	TE impact of an isolated 1 std. dev. up change	TE impact of a correlated 1 std. dev. up change	Marginal contribution to TEV	Percentage of tracking error variance (%)	Contribution to TEV
MBS SPREAD & VOL.										
Dutch RMBS	DTS (Yr*%)	.752	.000	.752	29.78	-22.38	-237.06	27.411	8.00	20.60
Italian RMBS	DTS (Yr*%)	.312	.000	.312	30.56	-9.55	-198.81	23.586	2.86	7.37
Spanish RMBS	DTS (Yr*%)	2.740	.000	2.740	21.56	-59.07	-244.33	20.450	21.75	56.03
UK Prime RMBS	DTS (Yr*%)	1.178	.000	1.178	26.66	-31.41	-232.48	24.062	11.01	28.35
UK Non-conforming RMBS	DTS (Yr*%)	.563	.000	.563	26.61	-14.99	-222.33	22.967	5.02	12.94
Other Euro RMBS	DTS (Yr*%)	1.612	.000	1.612	21.00	-33.85	-241.35	19.672	12.31	31.72
CMBS SPREAD										
Non-UK Euro CMBS	DTS (Yr*%)	2.152	.000	2.152	21.38	-46.00	-246.25	20.441	17.07	43.98
UK CMBS	DTS (Yr*%)	1.131	.000	1.131	24.44	-27.65	-234.45	22.250	9.77	25.17
ABS SPREAD										
Other Euro ABS	DTS (Yr*%)	1.369	.000	1.369	17.12	-23.44	-221.27	14.708	7.82	20.14
General GBP ABS	L_OASD (Yr)	.539	.000	.539	30.08	-16.22	-131.94	15.410	3.22	8.31

Source: POINT, Barclays Capital

Finally, the model is integrated with Barclays Capital tail-risk model, which is accessible in POINT via the same risk reports. Users can read from the corresponding risk report the Value-at-Risk and Expected Shortfall measures at custom tail levels. Tail risk is further decomposed by security or risk factor partitions. For more details, please see Lazanas et al (2009).

CONCLUSION

The second-generation Barclays Capital Pan European ABS FRN Risk Model incorporates important innovations such as the empirically documented relationship between systematic and idiosyncratic volatility and DTS. Following the evidence presented, the relation of DTS to systematic risk is allowed to vary by collateral type. Results show that the model forecasts well the increase in volatility during the financial crisis that started in 2007 and the subsequent fast decline in volatility. Moreover, the model can appropriately distinguish among the different levels of volatility across both collateral-types (e.g. CMBS is more risky than RMBS) and ratings (e.g. BBB are more risky than AAA).

References

A. Ben Dor, L. Dynkin, P. Houweling, J. Hyman, E. Van Leewen, and O. Penninga, 2005, *A New Measure of Spread Exposure in Credit Portfolios*, Fixed Income Research, Lehman Brothers.

L. Dynkin, A. Desclee, A. Gould, J. Hyman, D. Joneja, R. Kazarian, V. Naik, and M. Naldi, 2005, *The Lehman Brothers Global Risk Model: A Portfolio Manager's Guide,* Fixed Income Research, Lehman Brothers.

R. Gabudean, 2009, *US Home Equity ABS Risk Model*, Barclays Capital.

R. Gabudean, 2010, *US CMBS Risk Model*, Barclays Capital.

A. Lazanas, B. Phelps, and R. Gabudean, 2009, *A Portfolio Manager's Guide to Barclays Capital Tail Risk Model*, Barclays Capital.

A. Silva, 2009a, *New Approach to Credit in the Barclays Capital Global Risk Model,* Barclays Capital.

A. Silva, 2009b, *Emerging Market Risk Model,* Barclays Capital.

D. Tattan, J. Myers, B. Upbin, L. Phillips and L. Goberman, 2010, *Barclays Capital Pan European ABS Benchmark Indices,* Barclays Capital.

D. Tattan, 2007, *Launching European ABS in POINT. Essential tools in a challenging market,* Barclays Capital.

Index Research, 2008, *A Guide to the Lehman Brothers Global Family of Indices,* Fixed Income Research, Lehman Brothers.

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