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Western Europe

Granite – Structure and Hedging

Credit Options Best to Reduce Price Swings

- **Liquidity of Granite Also Creates Volatility** — With a total notional of £17 billion outstanding, Granite is one of the most liquid European securitized shelves and thus vulnerable to investor selling in times of market stress.
- **Credit Index Hedges are Popular** — The high correlation between Granite and iTraxx Main, seen most recently during the last two summers of the European debt crisis, have led dealers and investors to short Main to smooth out P&L volatility.
- **Credit Options are More Suited to Reducing Losses** — Index hedges can give up the gains from a core-long position during a rally, as we saw in the period from June 2012 to March 2013. In contrast, credit index options have limited downside in rallies and provide upside during downturns.
- **We Recommend Out-of-the-money (OTM) Put Options on Main** — The strike spread at which OTM options pay is wider than today's index spread, but investors will pay less premium, depending on the strike, than an at-the-money option.
- **Payer Spreads for Dealers Needing at-the-money (ATM) Protection** — Those that need immediate gains as spreads widen can reduce the cost of expensive ATM options by simultaneously selling options struck at wider levels ('payer spreads').
- **Overview of Master trusts and Granite Shelf** — The enclosed note gives an overview of the UK Master Trust structure, of which Granite is an example, and the changes in Granite cash flow waterfall after the breach of a trigger in 2008.

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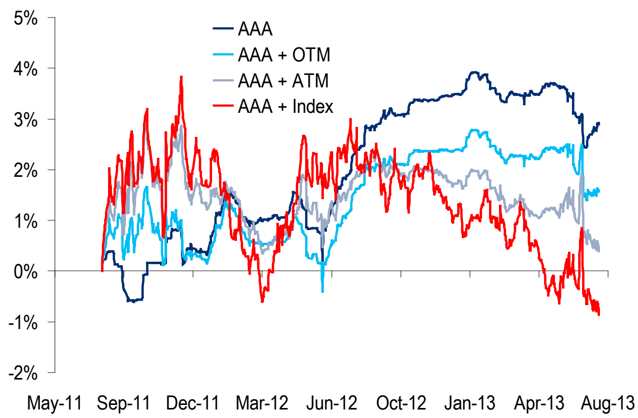
Figure 1. Credit Options Outperform Index Hedges



Past performance is no guarantee of future results. Results do not take into account fees and other transaction costs.
Source: Citi Research

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Credit Resilience but Market Beta

Granite Pillar of UK RMBS

At £17 billion equivalent, Granite is the largest amortizing mortgage trust in Europe and is therefore the most liquid shelf within the European securitized sector. Thanks to its size and liquidity, senior Granite bonds have enjoyed the status of UK RMBS market benchmark for a long time. As the recent sell-off in European credit market post the US Fed's QE tapering comments showed, even relatively short duration senior Granite bonds are not immune to market tremors. Although there is no dearth of buy-and-hold investors in Granite, many investors such as funds and dealers are sensitive to mark-to-market. Moreover, latest Basel III rules (which were most recently subject to a vote by the US Fed for implementation in the US) have made it difficult for bank investors to insulate their capital ratios from price swings in bond portfolios (see Global Structured Credit Strategy). For such price sensitive investors, the benefit of low credit risk needs to be balanced with the ability to minimize price volatility.

For investors unfamiliar with the Granite structure, the shelf is an example of a UK master trust structure. Unlike other master trust structures which are backed by a revolving collateral pool, Granite is winding down as no new mortgages are being added to the pool after the so called non-asset trigger breach in Nov 2008. Moreover, Granite's liquidity improved further after the pool became static. We provide a brief overview of Granite's structure at the end of this report. Low realized mortgage pool losses combined with the amortizing structure makes Granite senior bonds a relatively low credit risk product (Figure 2). Unfortunately, though, their large outstanding volume makes them a liquid sector and therefore vulnerable to systemic market moves such as what we saw in the credit markets in May (Figure 3). In this note, we recommend possible hedging strategies for Granite using index options and show their outperformance versus vanilla index hedges.

Figure 2. Credit enhancement of Granite Senior Bonds, Jun 06 – Jun 13 (%)

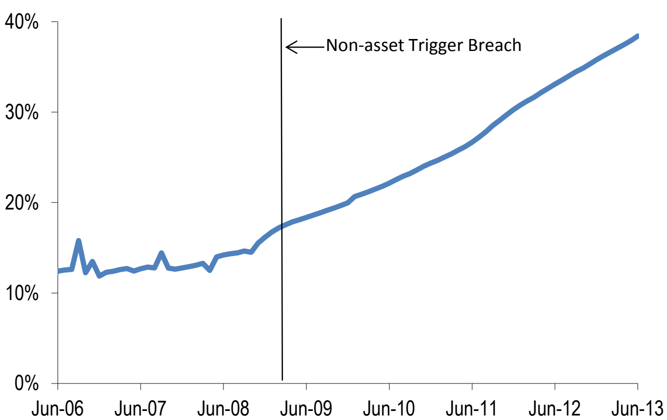

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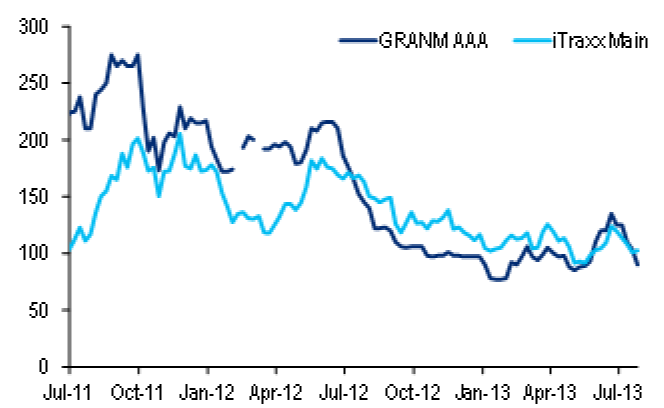
Figure 3. Granite senior and iTraxx Main spreads, Jul 11 – Jul 13 (bp)



Source: Citi Research

Hedging Alternatives

Buying Index Protection Can Backfire….

Traditionally, investors in Granite bonds have used credit index hedges to smooth out some of the P&L volatility. In general, such hedges have performed well in periods of crisis because Main spreads are quite correlated to Granite AAA spreads (Figure 3). Specifically, if we look at the period between June 2011 (the start of the second installment of the European debt crisis) and July 2013, the correlation between Main and Granite spreads is 68%, which is reasonably high.

However, while a credit index hedge does partially compensate for the losses on a long AAA Granite portfolio during a market downturn, it can also take a significant bite out of the profits from the core long position when markets rally. We find that when AAA Granite rallied between Jun 2012 and Feb 2013, the index also rallied; thus, AAA Granite hedged with an equivalent amount of index would have lost a large portion of the gains from the core long portfolio during the rally.

Since it is difficult to predict the turning points for markets, it is usually the case that investors are unable to judge when to take off an existing hedge and are forced to suffer the consequences if markets rally instead of going down. Using credit index shorts to reduce P&L volatility can negatively impact returns in a market rally.

….While Credit Options Can Help

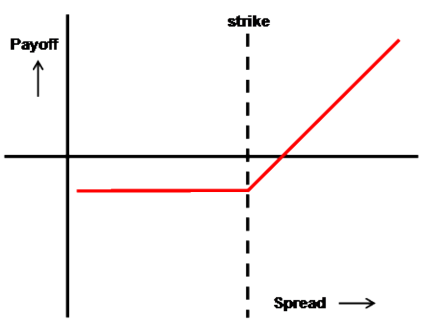
Investing in options is not suitable for all investors. Please see the disclosures concerning the risks of investing in options below and discuss with your Financial Advisor whether this particular options strategy is suitable for you. Note that all option prices are indications, based on intraday prices as of 30 July 2013. Interested investors should contact our trading desk for updated price and liquidity information. Also, complex option strategies may entail higher commissions costs.

An alternative to using credit indices as a hedge would be to use credit index options. Unlike index hedges, which are directional in nature and can negatively affect performance during market rallies, the downside in buying options is limited to the premium whereas the upside is unlimited depending on the type of option.

A credit option provides the option buyer (in return for a premium) the right, but not the obligation, to enter into a credit default swap on an underlying index (e.g. iTraxx Main) on a given date (option expiry) at a specified spread or price (called the strike). An option with a strike equal to spot (or current index level) is an at-the-money (ATM) option. An out-of-the-money (or OTM) option is one where the strike is different from the current index spread.

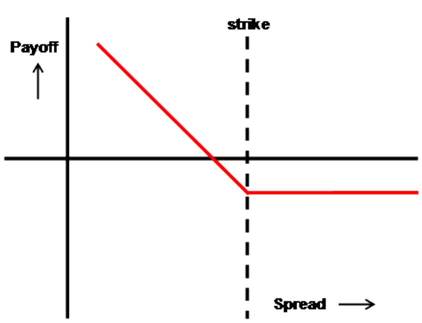
Within the context of hedging Granite, a payer (or a put option) is more relevant than a receiver (or a call option) on iTraxx Main. The buyer of the payer has the right to buy protection at the strike on option expiry – if spreads have widened more than the strike, the option is in the money (Figure 4), and the option buyer can cash out. Similarly, the receiver gives the option buyer the right to sell protection at the strike on option expiry, and benefits if spreads have tightened below the strike (Figure 5). For an OTM payer the strike is wider than current spread whereas for an OTM receiver option, the strike is lower than spot. In both cases, the option buyer is subject to a finite downside (limited to the option premium paid) but has unlimited upside if spreads move in the right direction.

Figure 4. Payoff of payer on expiry



Source: Citi Research

Figure 5. Payoff of receiver on expiry



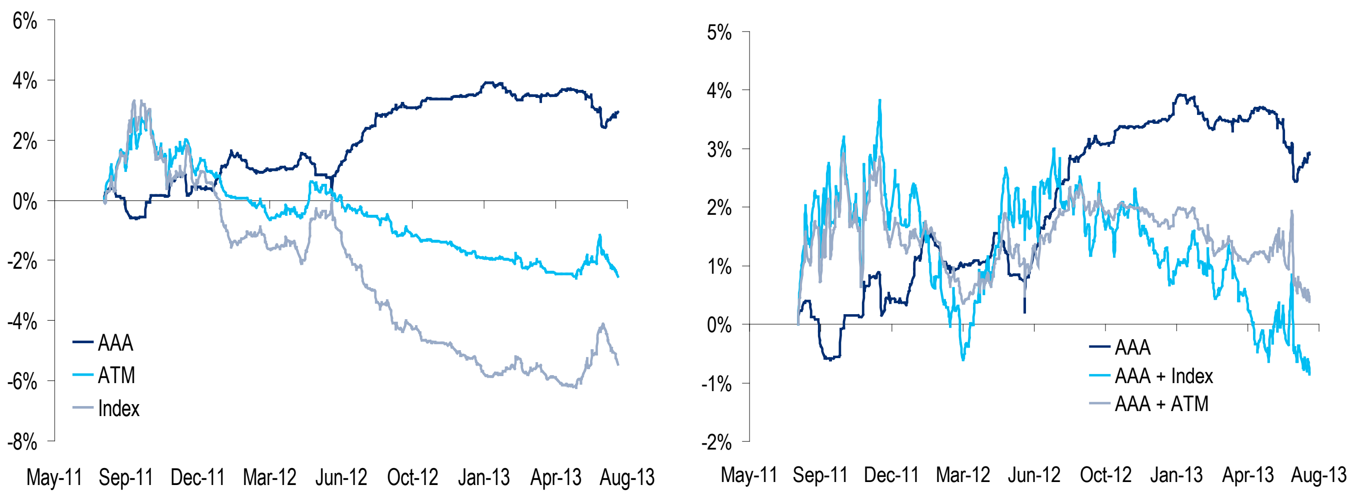
Source: Citi Research

Option Outperforms Index

To compare the efficiency of using options versus index hedges, we perform a back test during the period between May 2011 (the start of the second installment of the European debt crisis) and July 2013. The index hedge has the same face notional as the AAA Granite portfolio. For hedging using options, we use a 3 month ATM put option that is exercised immediately upon expiry if it is in the money. A new option position is then created with an expiry 3 months into the future with a new ATM strike. We assume that the face notional for the option is equal to the face notional for the AAA Granite portfolio. The resulting P&L graph for the hedged portfolio is shown in Figure 6.

We find that the ATM put option functioned as an effective hedge up to Sep 2012, matching the performance of the index short. However, post Sep 2012 (when the European OMT was announced), we find that the performance of the option hedged portfolio did significantly better than the index hedged portfolio, mainly because of the capped downside in put options during periods of market rallies. In other words, an ATM option hedge provides most of the protection of an index hedge during a downturn but takes less of a P&L hit during a market rally.

Figure 6. Both index and ATM option hedge P&L (cumulative, % of face notional) show negative correlation to the P&L from a long Granite AAA portfolio (left), but the ATM option hedge provides better performance when markets rally (right).



Past performance is no guarantee of future results. Results do not take into account fees and other transaction costs.
Source: Citi Research

But What About the Costs?

The disadvantage with ATM options is that in return for what we consider the best possible protection (limited downside, unlimited upside), the option buyer must pay a high price (premium) for the privilege. So, if the option is out of the money (i.e. worthless) at option expiry, the option buyer can be down the premium amount, which can be substantial.

In fact, this is the main reason why we saw the option hedge performance suffer post Sep 2012. As markets rallied, the put options kept expiring out of the money (so there was no payout), but the investor was forced to pay a substantial premium to purchase the option after every option expiry, which offset the P&L from the long AAA Granite portfolio. Put differently, even though ATM option hedges limit the

downside in market rallies (especially when compared to index hedges), the downside limit can be high.

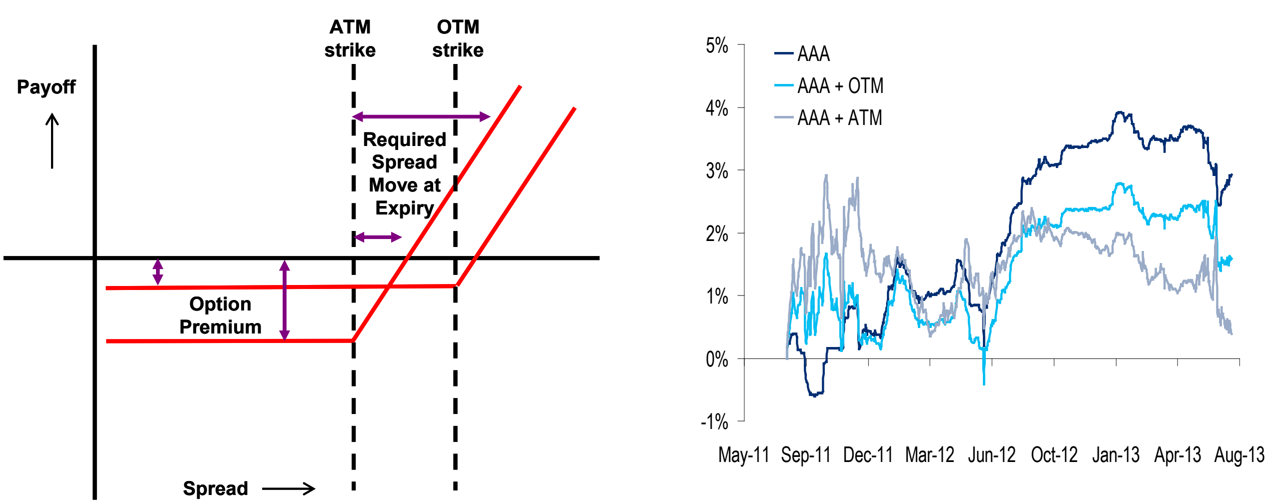
So what can we do about this? One alternative is to look at options that have lower cost, but provide less protection. Market participants who use option hedges typically consider out-of-the-money (OTM) put options for this purpose.

Remember that an OTM put option has a strike spread that is higher than the current spread of the underlying (i.e., the ATM strike). Therefore, the protection only kicks in if spreads widen sufficiently at option expiry to exceed the (high) OTM strike. In return for this reduced level of protection, the option buyer pays a lower premium. The more out-of-the-money the option is, the lower the premium, and the more extreme is the spread move needed for the protection to kick in at expiry (see left diagram in Figure 7 for an illustration).

For our back testing, we use 20% delta OTM option with a 3 month expiry. The delta of an option quantifies how sensitive the option is to price moves in the underlying index. An option with 20% delta changes its price by 20% every time the price of the underlying index changes by 1 unit. The lower the delta, the more OTM is the option. An ATM option typically has a delta of around 50%, so an option with 20% delta is reasonably out-of-the-money. As before, we assume that the option is exercised immediately upon expiry if it is in the money, and then rolled into a new 20% delta option position.

We show the cumulative P&L from AAA Granite portfolio hedged with an OTM option, in the right diagram in Figure 7. We observe that the loss mitigation during the summer and fall of 2011 was not as effective as an ATM option hedge. However, the OTM option hedge gives up less of the gains during the rally in the post Sep 2012 period. The performance post Sep 2012 was primarily driven by the lower option cost since most of the options during this period expired worthless because of the steady rally in spreads.

Figure 7. Trading off cost (premium) for protection – ATM options have higher cost, but require less spread widening at expiry to pay off (left), so the OTM option hedge provides a little less protection during market stress, but preserves more of the P&L during rallies (right, P&L shown is % of face notional).



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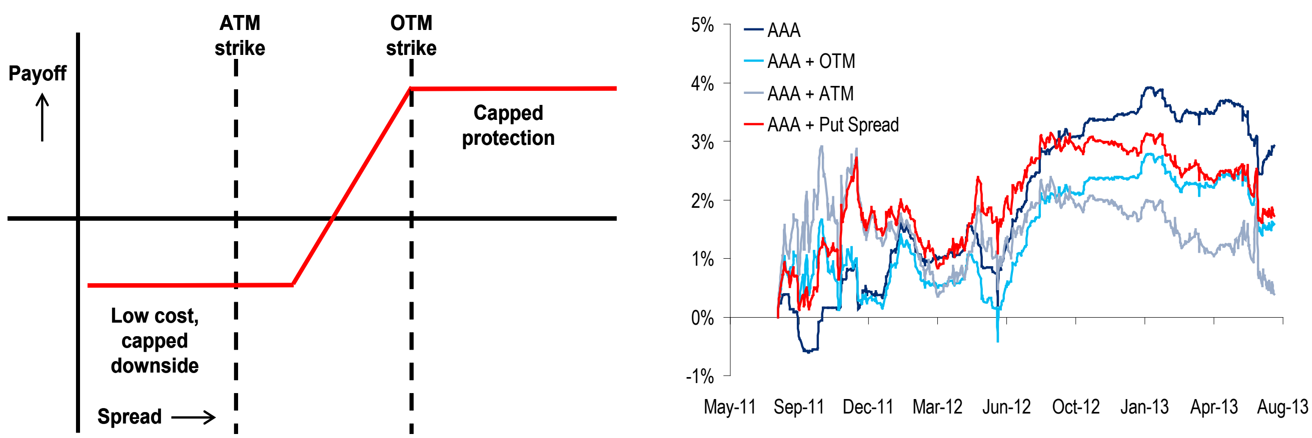
Source: Citi Research

Best of Both Worlds – A Put (Payer) Spread

So what should an investor do when faced with these choices? Which one is a better hedge? On the one hand, we have an OTM option hedge that has a low cost (good during periods of market rallies) and provides protection only when spreads widen significantly. In contrast, an ATM option hedge is expensive but provides protection at expiry if spreads start to widen from current levels[1]. Can we combine the good features of both these strategies and create something that has a low cost, but does not require a large amount of spread widening to provide protection?

It turns out that the answer is yes, with a certain caveat. The option structure that can be used for this purpose is called a "put spread", where an investor buys an ATM option and sells an OTM option to (partly) finance the ATM option. So the cost is lower, and at the same time, the investor gets protection if spreads widen from current levels upon option expiry, because they own the ATM option.

Figure 8. Put spreads provide a good tradeoff between cost and protection (left), P&L (% of face notional) for a put spread hedge (right).



Past performance is no guarantee of future results. Results do not take into account fees and other transaction costs.
Source: Citi Research

Where is the catch in this? Well, the tradeoff is in how much protection the investor can get. Since the investor sells an OTM option, if spreads widen beyond the strike of the OTM option, the potential payoff received gets capped – see left diagram in Figure 8 for details. In other words, if spreads widen, but remain range bound, this is the hedge that works really well.

We show the how the put spread hedge performs in our back testing in the right diagram in Figure 8. In this case, we have used a 3 month put spread where the investor buys an ATM option and sells a 20% delta OTM option, both with face notional equal to the AAA Granite portfolio notional. Once again, the entire option position is rolled into a new put spread position upon expiry, after exercising the expiring option if it is in the money.

As the graphs show, the put spread hedge (in red) does come close to matching the performance of the ATM hedge during the summer and fall of 2011, but performs really well during the post Sep 2012 period because of its low cost. Finally, we have a hedge that does well during both market rallies and downturns!

[1] Technically speaking, the spreads must widen by a certain minimum to account for the premium paid before we see positive P&L at option expiry.

Key Point: Credit options are very flexible instruments that can be tailored to provide protection for specific scenarios at an optimal cost. Unlike credit index hedges, credit option hedges can be structured to limit P&L loss when markets rally while providing reasonable protection when there is a market downturn.

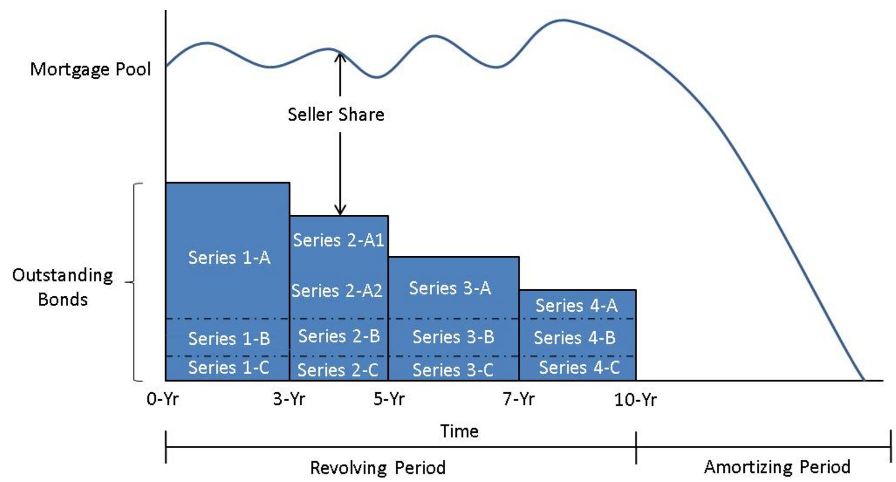
UK RMBS Master Trust Overview

What is a Master Trust

A master trust is a legal structure in which a pool of assets is jointly owned by the originator (seller) and investors in bonds backed by those assets. The investors' (also called 'funding share') is equal in size to all the RMBS tranches outstanding and the 'seller's share' is equal to total mortgage pool minus the funding share (Figure 9). The proportion of the asset pool owned by each party may vary with time.

The master trust design facilitates issuance of multiple series of notes backed by a common revolving pool of collateral. The originator may purchase new mortgages with principal repaid from existing ones or may increase the trust size by funding loan purchases by issuing new notes or increasing the seller share. While new loans must adhere to pre-defined criteria in order to qualify for inclusion in the mortgage pool, overall pool characteristics may change with time as old loans repay and originators modify their underwriting criteria in line with evolving market practices. Figure 9 outlines a generic master trust structure with multiple issuance of notes demonstrating the evolution of collateral balance as repayments from old loans used to repay notes or buy new loans from the originator, or the seller boosts its share to fund new collateral.

Figure 9. Generic Master Trust Structure



Source: Citi Research

The master trust structure benefits both issuers and investors. It enables issuers to create soft-bullet and controlled amortization bonds with far less cash-flow volatility and shorter maturities than traditional standalone RMBS structures. Once established, a master trust enables issuers to access capital markets more quickly and efficiently by issuing new series of notes using the existing structure. The use of a large common collateral pool also streamlines investors' credit analysis for future purchases and simplifies ongoing monitoring. Moreover, investors prefer the greater risk diversification provided by large asset pools and take comfort from the originator skin-in-the-game via the joint ownership structure.

Triggers Impact Payment Priority

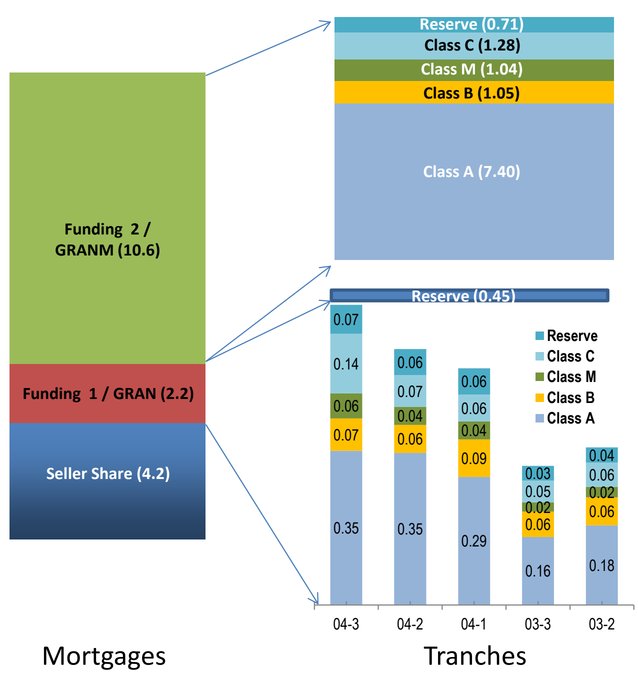
Under normal circumstances, the seller share ranks pari passu with the funding share(s) for the principal and interest payments from the mortgage pool. The principal payment priority within a funding share is generally governed by the planned amortization profiles of the tranches. However, several structural features

and triggers linked to collateral performance (asset triggers) or independent events unrelated to collateral performance (non-asset triggers) exist to preserve note holders' capital and can lead to the trust becoming static and entering amortization. An asset trigger breach occurs after a severe deterioration of the loan pool and may for instance abandon all the scheduled maturities and change the payment priority to sequential in order of tranche seniority based on ratings. An asset trigger is curable and does not lead to a wind-down of the trust. A non-asset trigger, on the other hand, happens because of events because of originator insolvency or failure to maintain pool size or failure to provide satisfactory loan servicing and can lead to a wind-down. A non-asset trigger not only accelerates payments to senior classes in order of their legal final maturities but also diverts all the principal cash flows exclusively to the funding share with none going to the seller till the tranches are repaid. In the case of Granite, there was a breach of a non-asset trigger because of the insolvency of Northern Rock Plc, the originator for the Granite shelf.

Recap of Granite Master Trust

Granite master trust was incorporated in 2001 by Northern Rock Plc to issue notes backed by residential mortgage loans originated in England and Wales and comprised of roughly £50 billion of mortgages at its peak in 2007. The structure comprises of two funding vehicles — Funding (GRAN) and Funding 2 (GRANM). Northern Rock utilized GRAN vehicle to issue first ten transactions (from 2001 to 2004) and started issuing from GRANM vehicle in 2005. Notes from both the shelves are still outstanding but GRAN has much smaller share of around £2.2 billion while GRANM stands at around £10.6 billion (Figure 10). Since the wind-down of the trust in 2008, the mortgage pool and senior tranche notionals have declined.

Figure 10. Current Capital Structure of the Granite Master Trust, as of May 2013 (All notional amounts in £ billion)



Source: Citi Research

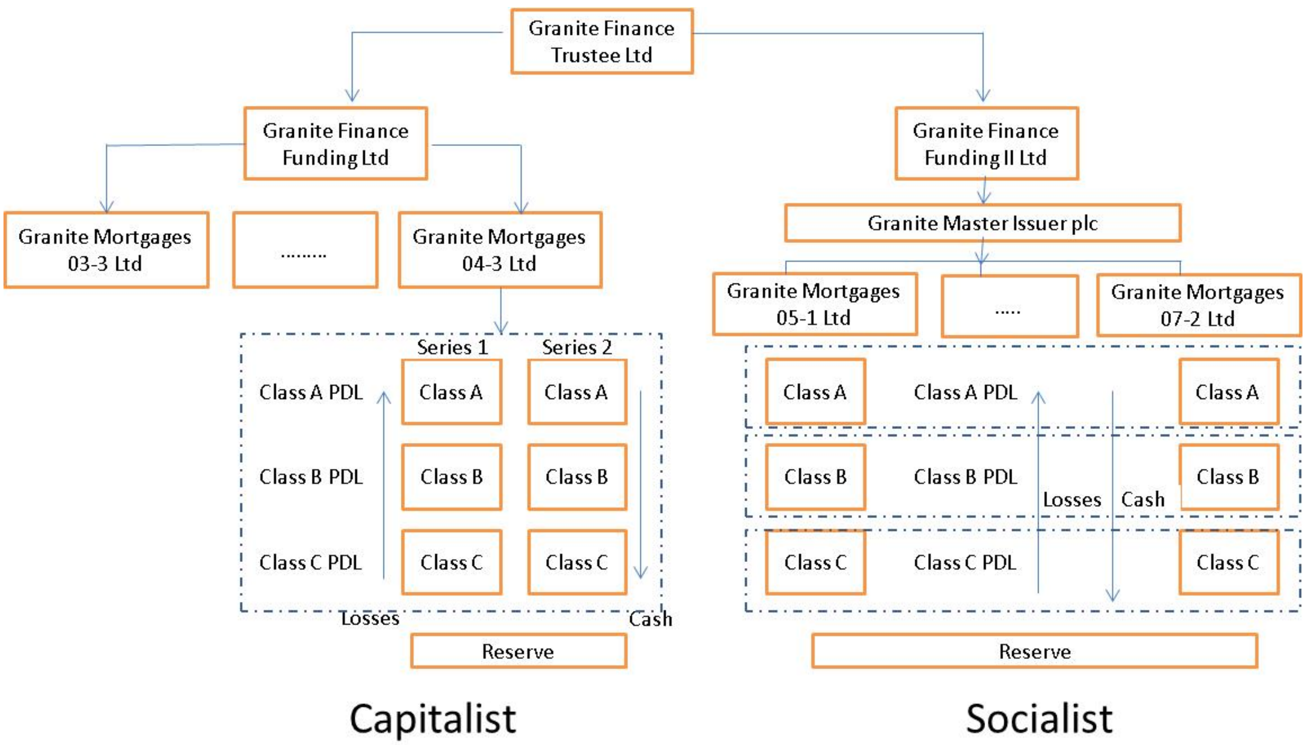
Socialist and Capitalist Structures

The two funding vehicles in Granite have different structures — Funding is a so called "capitalist" structure while Funding 2 is a "socialist" structure. We provide a brief overview of these structures below. Figure 11 contains a diagrammatic representation of the two structures in Granite.

The socialist structures consist of a single reserve fund at the funding level, providing credit enhancement (CE) to all notes issued across different series in the master trust. The size of the reserve fund changes as new notes are issued and all the newly issued subordinate tranches contribute to the CE of previously issued senior tranches. Moreover, the principal deficiency ledgers (PDLs) are also at the funding level and separated by ratings of tranches. For instance, all triple-B classes across the different issuers would share the same PDL and any loss registered on this PDL is shared by all triple-B rated notes on a pro-rata basis. A good portion of current outstanding Granite master trust comprises of socialist structure GRANM, consisting roughly £10.6 billion of RMBS notes supported by a £0.7 billion reserve fund.

The capitalist structures employ reserve funds and PDLs for different issuers and there is no interdependence between notes of different issues. The level of reserve fund and PDL balance in one transaction do not influence the notes of other issuers. In theory, this means that a note with a particular rating could suffer a principal deficiency while a similar rated but better enhanced note by another issuer would not suffer a principal deficiency, although they are backed by the same master trust property. However, in practice this is unlikely because CE for a given rating would not change significantly between issuances. Since Northern Rock abandoned issuing from the capitalist structure in 2004, only £2.2 billion of GRAN notes from five different issues are currently outstanding.

Figure 11. Socialist and Capitalist Funding Structures within Granite Master Trust



Source: Citi Research

Granite Post Non-Asset Trigger Breach

As with most master-trusts, Granite's cash flow waterfall has simplified significantly following the non-asset trigger breach. The interest receipts are allocated pro-rata between the Funding, Funding 2 and the Seller's share while principal receipts are allocated only to the funding vehicles. The seller share is locked out of receiving any principal payments until all the notes from the two funding are repaid in full. However, any realized losses would be allocated pro-rata between the funding vehicles and seller's share. The modified payment priority not only accelerates note repayments but also could potentially provide considerable credit protection to the notes if defaults are back loaded.

However, the priority of principal payments within Funding and Funding 2 notes are different because of structural differences related to capitalist and socialist funding. Funding (GRAN) follows capitalist funding and its principal share is allocated pro-rata between various issues which then allocate it in sequential order based on rating. Currently there are only 5 GRAN shelves outstanding from Granite Mortgages 03-3 to Granite Mortgages 04-3. The issuer-specific tranches are shown in Figure 10.

Funding 2 (GRANM) allocates principal receipts to its tranches in strict sequential order based on ratings. For example, all Class A notes of Funding 2 are currently paid pro-rata irrespective of their series and Class B notes will start amortizing only after all the Class A notes are repaid in full and so on. Consequently, there are no structural differences between various GRANM tranches having same ratings other than their currencies. Currently there are only 5 GRAN shelves outstanding from Granite Mortgages 05-1 to Granite Mortgages 07-2. As the tranches are pari-passu

within each rating category, the total notional amounts (£ billion equivalent) across issuers are shown in Figure 10.

RISKS

When buying calls and puts (or receivers and payers) the maximum loss is the premium paid. When selling calls (or receivers), the maximum potential loss would occur as the index spread decreases but is limited by the index spread being floored at zero. For puts (or payers), the maximum potential loss (amount below the strike) would eventuate should the index price fall to zero. Sector index options are cash settled. The above calculations do not include any additional fees or transaction costs. Note that ratio writing would leave the writer uncovered in one leg of the trade.

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Investing in options other than Standardized Options may entail additional risks.

Notes

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Appendix A-1

Analyst Certification

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