INSIDE MORTGAGE VALUATION

A Guide to Using Barclays Capital Live

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Effective COB May 6[1], 2011, Barclays Capital will be using the new agency fixed-rate prepayment model for all Barclays Capital mortgage analytics including the MBS index. These models were introduced in "Beta Mode" on March 18, 2011. For a detailed description of the model please refer to the March 17 article titled *Inside Mortgage Valuation-A Guide to Models on Barclays Capital Live*.

The new model constitutes a significant enhancement to our agency prepayment model framework. It not only incorporates the effects of important collateral attributes and macroeconomic factors, but also captures major changes in underwriting standards, origination costs, and policy initiatives. In addition, a highly flexible user interface allows clients to edit or override many of these effects. In short, this expanded and more flexible model structure will allow users to quickly respond to changes in the mortgage market, run customized what-if scenarios, quantify risks, or express relative value views contingent on changes to underwriting standards, home prices or policy initiatives. This article will serve as a guide to users on more effectively using the new models on Barclays Capital Live to analyze agency MBS securities with an emphasis on customizing the calculators to reflect the user's preferences and views.

[1] Based the feedback received from our clients, we have decided to postpone the release of the new model into production from the originally scheduled April 21, 2011 to May 6, 2011 to allow more time for implementation. Meanwhile, the new model can still be accessed in Beta mode in the Beta Calculators/Models area on Barclays Capital Live.

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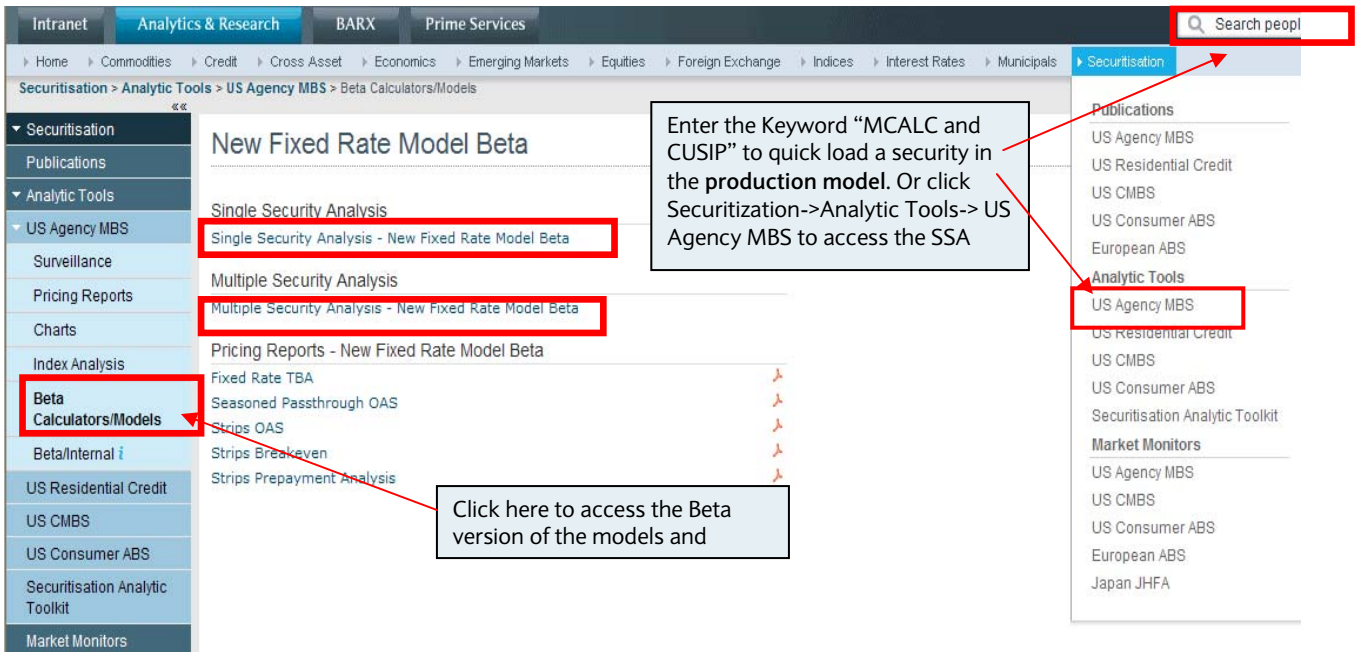
Loading securities into the Single Security Analysis

Barclays Capital Live offers two calculators for residential mortgages, the Single Security Analysis (SSA) and the Multiple Security Analysis (MSA). On any page of Barclays Capital Live, the easiest way to bring up the SSA is to type the keyword "MCALC" into the search field located at the upper right corner (Figure 1). Alternatively, users can access the daily pricing reports generated by the model with the keyword "MBSPR." By default, these keywords point to the production version of the model. However, if a Beta version is available it can be accessed through the Beta Calculators/Models link on the left-hand side panel. Pricing reports generated by the Beta model can also be found on the same page.

Figure 1: Accessing the Single Security Analysis on Barclays Capital Live

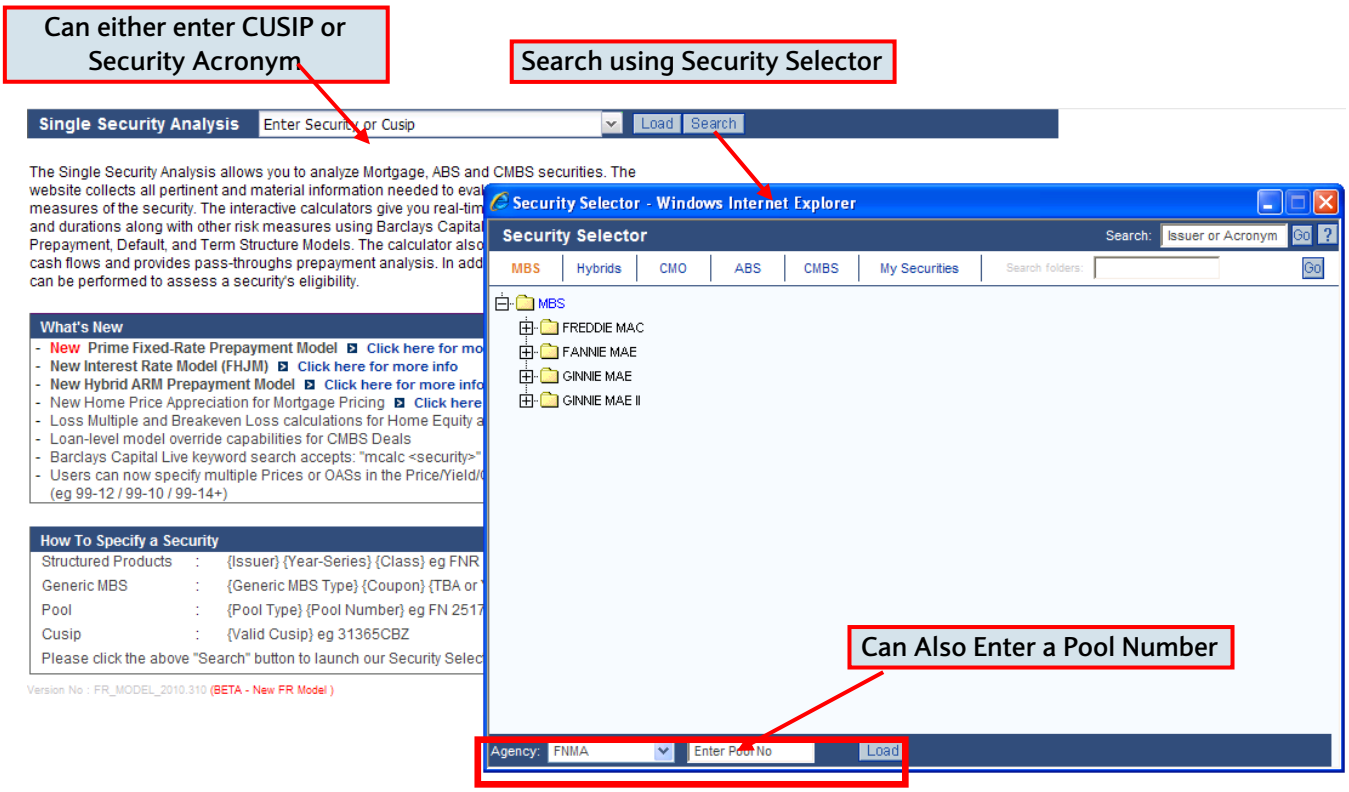


Source: Barclays Capital

Within the SSA, there are several ways to load a security. The easiest is to use the CUSIP or deal/cohort acronym. For example, to load FNMA pool AE6396, one can enter either "31419HDA"or "FN AE6396" into the SSA, as shown in Figure 2. To run the FNCL 5 TBA, the user can enter the acronym "FNCL 5 TBA." Figure 3 gives more examples and a list of product tickers for loading various types of cohorts.

Another way to load securities is to use the Security Selector, as shown in Figure 2. Here, the user can choose from a pop-up window containing a list of products, vintages, coupons, strips, and REMICs. There is also a short-cut way for accessing the calculator. For example, on any page of Barclays Capital Live, one can enter "MCALC FHR-3072 SG" or "MCALC 31396FKW2" to access the calculator loaded with FHR 3072 SG.

Figure 2: Loading a security in the Single Security Analysis



Source: Barclays Capital

Figure 3: Identifying MBS securities on Barclays Capital Live

		Identifier in SSA	
Security	**Description**	**Cusip**	**Acronym**
FNCL 5 TBA	FNCL TBA		FNCL 5 TBA
FNCL 4.5 2009 production	FNCL vintage cohort		FNCL 4.5 09
FNCQ 5 2010 production	FNCQ vintage cohort		FNCQ 5 10
FNR 2004-36 SA	FNMA CMO	31393X5V5	FNR04-36 SA
FHR 3072 SG	FHLMC CMO	31396FKW2	FHR-3072 SG
GNR 2010-114 NS	GNMA CMO	38377KAF7	GNR10-114 NS
FHR 3680 MA	New issue CMO		intex:ZFH3680G2X MA
FNS 397 IO	FNMA trust 397 IO	3136FGRS8	FNT-397 2
IOS FN-4509 IO	IOS FN-4509		IFN-34509 IO
FG A29561	Gold pool	31297HTS8	FH A29561
FN AE6396	FNCL pool	31419HDA	FN AE6396

Ticker	**Description**	**Ticker**	**Description**
FGLMC	FHLM Gold Guar Single F. 30yr	FNCT	FNMA Conventional 20yr
FGCI	FHLM Gold Guar Single F. 15yr	FNG	FNMA Relocation 30 Yr
FGTW	FHLM Gold Guar Single F. 20yr	FNCZ	FNMA Conv. Extra Long T. 40yr
FGI	FHLM Gold Relocation 30 Yr	FNNP	FNMA Conv. 30yr IO 10/20
FGK3	FHLM Gold Guar Single F. 40yr	FNNQ	FNMA Conv. 30yr IO 15/15
FGH0	FHLM Gold 30yr IO 10/20	FNJMCK	FNMA 30 Yr Jumbo
FGH1	FHLM Gold 30yr IO 15/15	FNCQ	FNMA 30yr high LTV (105 - 125)
FGJMT6	FHLM Gold 30yr Jumbo	GNSF	GNMA I Single Family 30yr
FGU6	FHLM Gold 30yr high LTV>105	G2SF	GNMA II Single Family 30yr
FNCL	FNMA Conventional Long T. 30yr	GNJO	GNMA I Single Family 15yr
FNCI	FNMA Conventional Interm. 15yr	G2JM	GNMA II Jumbo Conforming 30yr

Source: Barclays Capital

Basic features of the calculator

Given the dramatic shift in the prepayment landscape and increased disclosure from the agencies in the past few years, we have significantly updated the calculator display information for collateral, rates, and model outputs.

Security and collateral information in the SSA

We have expanded the collateral information in the SSA to present the latest disclosures and the most relevant information (such HARP-eligibility) affecting prepayments in the current environment. Figure 4 shows some of the highlights:

Historical CPR and buyout data for GNMA and FHLMC securities. These data are updated as they are released by the agencies. For example, the CPR and buyout breakouts for FHLMC securities are updated on the night of the fourth business day. However, for GNMA the total CPR is updated after the fourth business day, while the buyout breakouts are updated after about the 15th business day.

Delinquency and roll rates for GNMA and FHLMC securities. Because GNMA buyouts tend to be lumpy, they are a poor indicator of future long-term buyout speeds. A better gauge is the transition rate into the 90day+ delinquency bucket since this is the main driver for longer-term buyouts. On the calculator, we show both the annualized roll rate and the 30day, 60day, and 90day+ delinquency pipelines, which are used by the model for projecting near-term buyouts. All these numbers are updated after the 15th business day. For FHLMC bonds, we show the roll rate into 120day+ delinquencies (because that is when the GSE buy them out) and the 30day, 60day, and 90day delinquency rates. These are updated on a monthly basis on the fifth business day.

Percentage of previously loss-mitigated loans for GNMA securities. These are GNMA loans that became delinquent and were bought out by the servicers, went through loss mitigations (typically a modification[2]), and were re-delivered into GNMA pools. These loans typically have much higher default/buyout rates but lower refinancing speeds than regular GNMA loans, which are reflected in our GNMA prepayment model. We update this field based on the GNMA supplemental data typically released around the 16th business day.

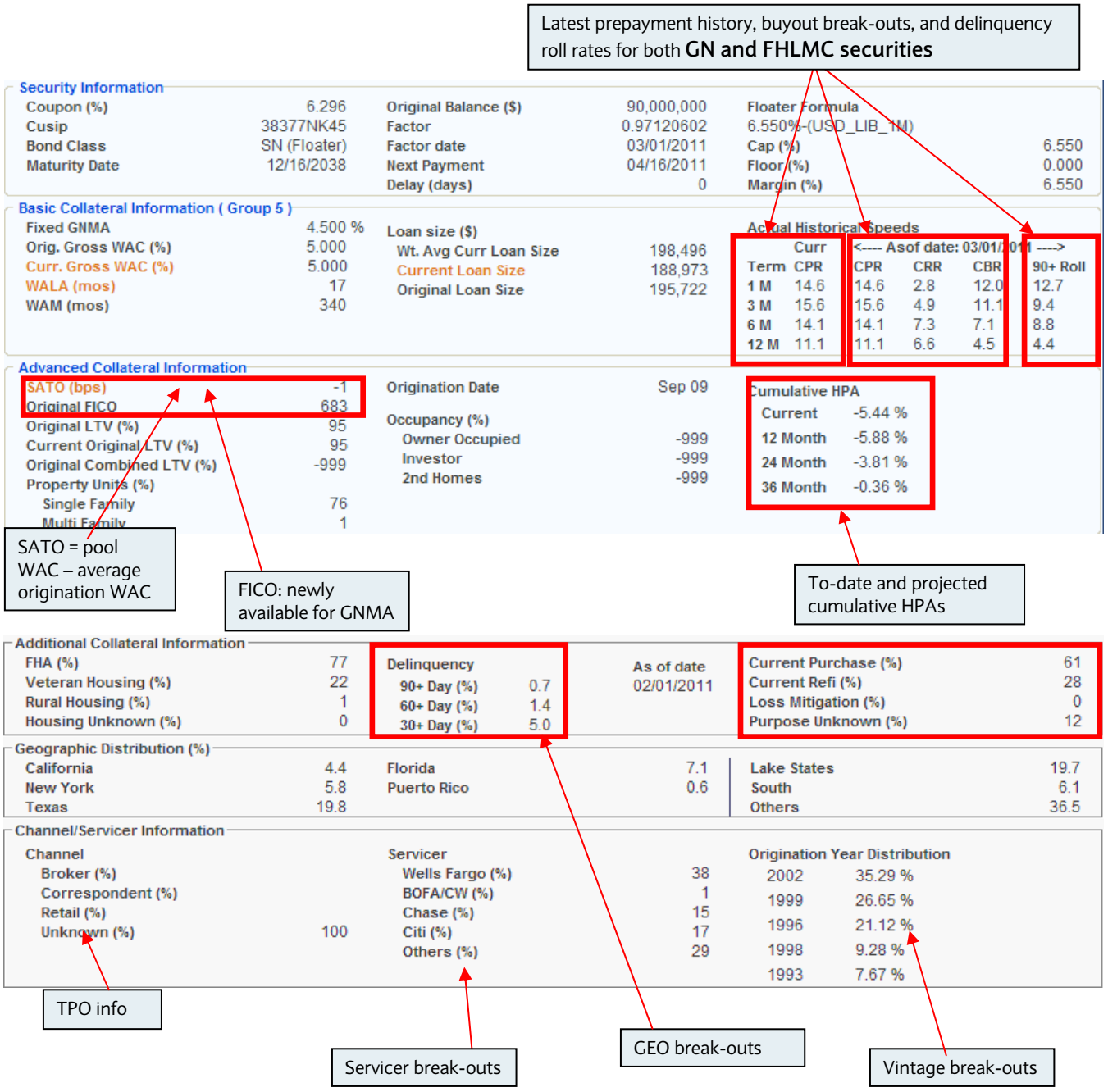
Spread-at-Origination (SATO). SATO has shown to be an important driver of both voluntary and involuntary speeds even after controlling for other factors. In our calculator, we define SATO as the difference between the WAC of a pool and the average WAC of all pools originated in the same month.

Cumulative HPA. Depending on the specific HPA path that the user chooses (more details on this in "The Home Price Appreciation Analyzer", section), the calculator displays the cumulative HPA that the collateral has experienced to date and 12 months, 24 months and 36 months forward. Together with original LTV, these numbers are used to generate the updated LTV along the forward paths, which affects the projected voluntary and involuntary prepayments.

Other important collateral information, such as WAC, WALA, vintage distribution, FICO, LTV, loan size, % refinance loans, % investor properties, % third-party-origination (TPO), %2-4 units, geographical distribution, and servicer composition are all displayed and used as inputs for prepayment projections.

[2] For details, see *GNMA servicing and prepayments: a deep dive*, October 30, 2009

Figure 4: Collateral information in the Single Security Analysis



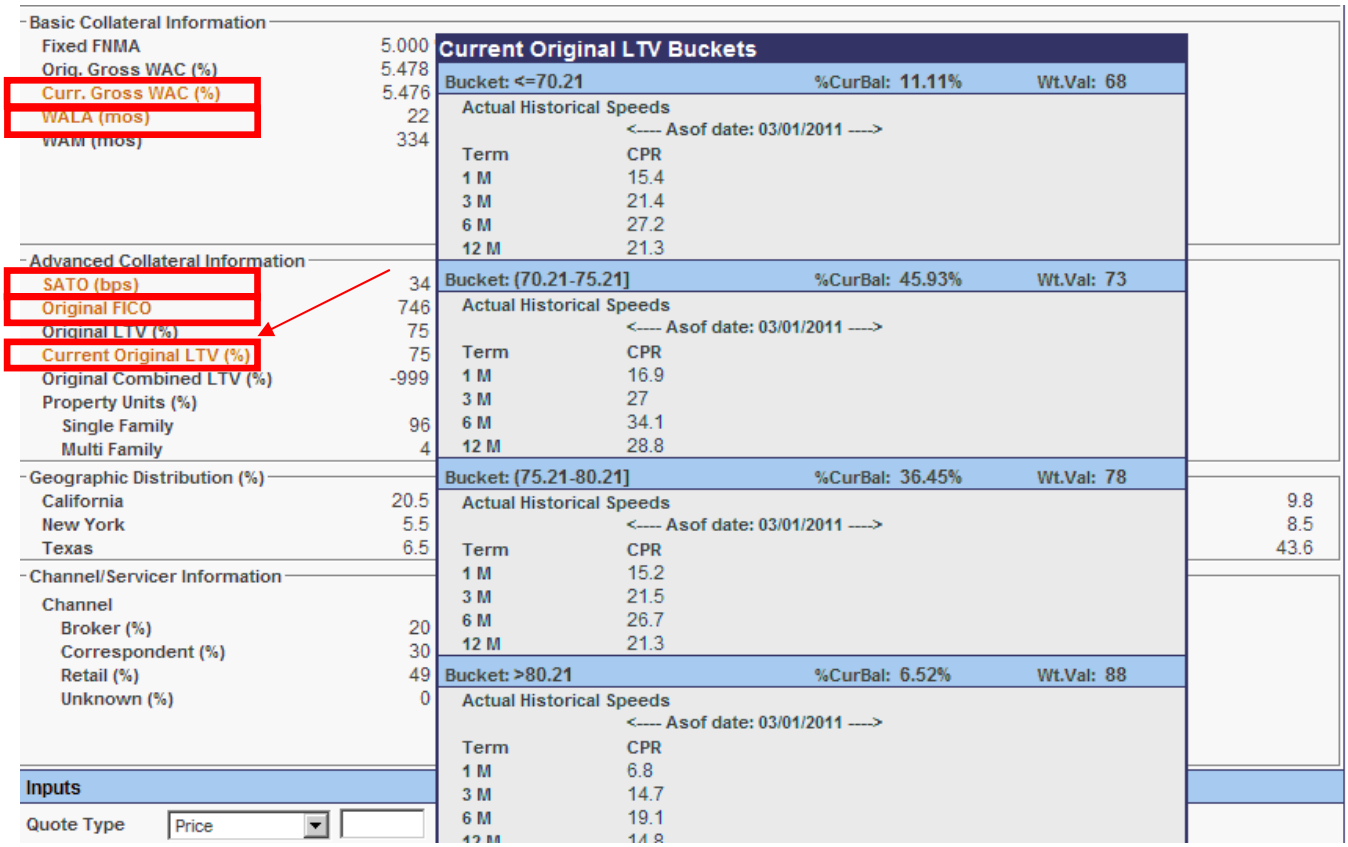
Source: Barclays Capital

Collateral dispersion for CMOs and mega pools. As an enhancement, the calculator now shows the dispersion of collateral backing CMOs for some of the most important attributes. For example, hovering the cursor over the *Current Original FICO* field gives you the distribution of the collateral backing the deal across four LTV buckets (Figure 5) as well as how the pools in each of the buckets have prepaid historically. This can be useful in understanding the prepay behaviours of specific deals and in adjusting the model to better reflect these idiosyncrasies. Generally, all orange-colored fields are hover-able including LTV, FICO, WALA, loan size, SATO, and WAC. We are also upgrading the calculator to show

prepayment breakouts by purchase/refinance loans, retail/correspondence/broker origination, occupancy, GEO, servicers, property units, and FHA/VA/RHS loans.

Exporting the security and collateral information. Clicking the  button in the upper right corner of the calculator page exports all the security and collateral details to a PDF file or the default email application.

Figure 5: Collateral characteristics breakouts: The hovering feature



Source: Barclays Capital

Pricing options

After a security is loaded, the user has the following pricing options (Figure 6):

Quote type

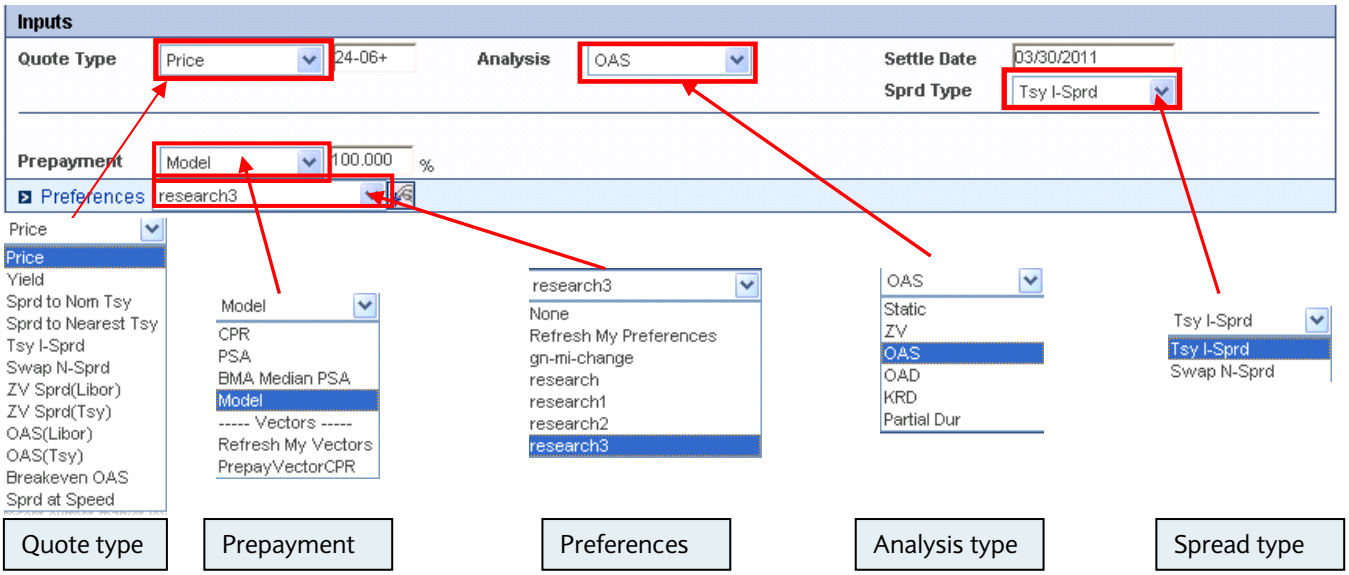
- Price/Yield/Spread/OAS—Price the security by specifying a dollar price, a pricing spread, or yield.
- Breakeven OAS –The calculator first backs out a multiple of the prepayment model such that the OAS of an IO and PO strip are the same and then apply this multiple of the model and the OAS of the IO/PO to the security. To use this option, the user needs to specify the IO/PO strip for backing out the prepayment model multiple.

Prepayment assumption

- Model – Apply Barclays Capital's prepayment model. When this option is selected, the user can enter a scalar to the prepayment model. For example, entering 80 would tell the calculator to use 80% of the model speeds for cash flow generation.

- CPR – Use static prepayment assumption expressed in CPR
- PSA – Use static prepayment assumption expressed in PSA
- Vector – Use a pre-defined prepayment vector

Figure 6: Pricing options in the Single Security Analysis



Source: Barclays Capital

Preferences

The user can choose one of the pre-defined sets of model preferences here. Selecting "*None*" will load the system-default preferences. Some commonly used types of preferences include the following:

- Prepayment model overrides – Override the turnover, cash-out, refinancing, and default components of the prepayment model to reflect the user's own view. In the "Prepayment model knobs" section on page 11, we provide more details.
- Calculator preferences – such as adjusting the primary-secondary spread model, changing the number of OAS paths, specifying whether to shift mortgage rates or swap rates while generating the S-curve, selecting regional HPA scenarios, choosing the aggregation scheme for the collateral, and setting model outputs. In the "Setting preferences for the calculator" section on page 19, we provide more details.

Analysis type

- Static – holds interest rates constant while generating price, yield, average life and 1y/3y/LT CPR/CDR/CRR projections. This is the most efficient option for generating model S-curves.
- ZV – generates cash flows assuming interest rates move along the forward curve. This gives ZV Spread, ZV Yield, and ZV average life, for example.
- OAS – Monte Carlo based Option Adjusted Spread metrics, such as OAS, spread duration, option costs.
- OAD – more OAS based metrics such as OAD, OAC, and spread convexity.

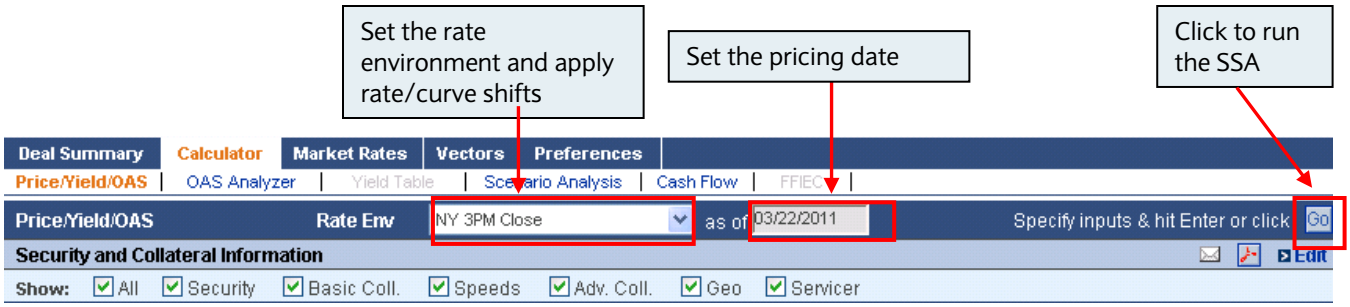
- KRD – Key Rate Durations, plus all the calculations in an OAD analysis
- Partial Duration – generates all partial durations such as prepayment duration, mortgage rate duration, refinancing duration, turnover multiplier duration, and HPA duration.

Note that the analysis type becomes incrementally more comprehensive and time consuming as you progress from Static through Partial Duration analysis. For example, a ZV analysis will automatically include all the outputs from a Static analysis, and a Partial Dur analysis will automatically give all the outputs from a Static, ZV, OAS, OAD, and KRD analysis.

Spread type

With this drop-down menu, the user can specify whether the pricing is relative to the Treasury curve or swap curve.

Figure 7: Running the Single Security Analysis



Source: Barclays Capital

Model outputs

After loading the security and setting the pricing options, the user can click the Go button in the upper right corner of the screen to run the calculator (Figure 7). The user also has the option to set the pricing date and rates environment before running the calculator. Once the calculation is complete, model outputs will automatically show up at the bottom portion of the page. Beside the outputs one can expect from most OAS models, there are several highlights in the SSA:

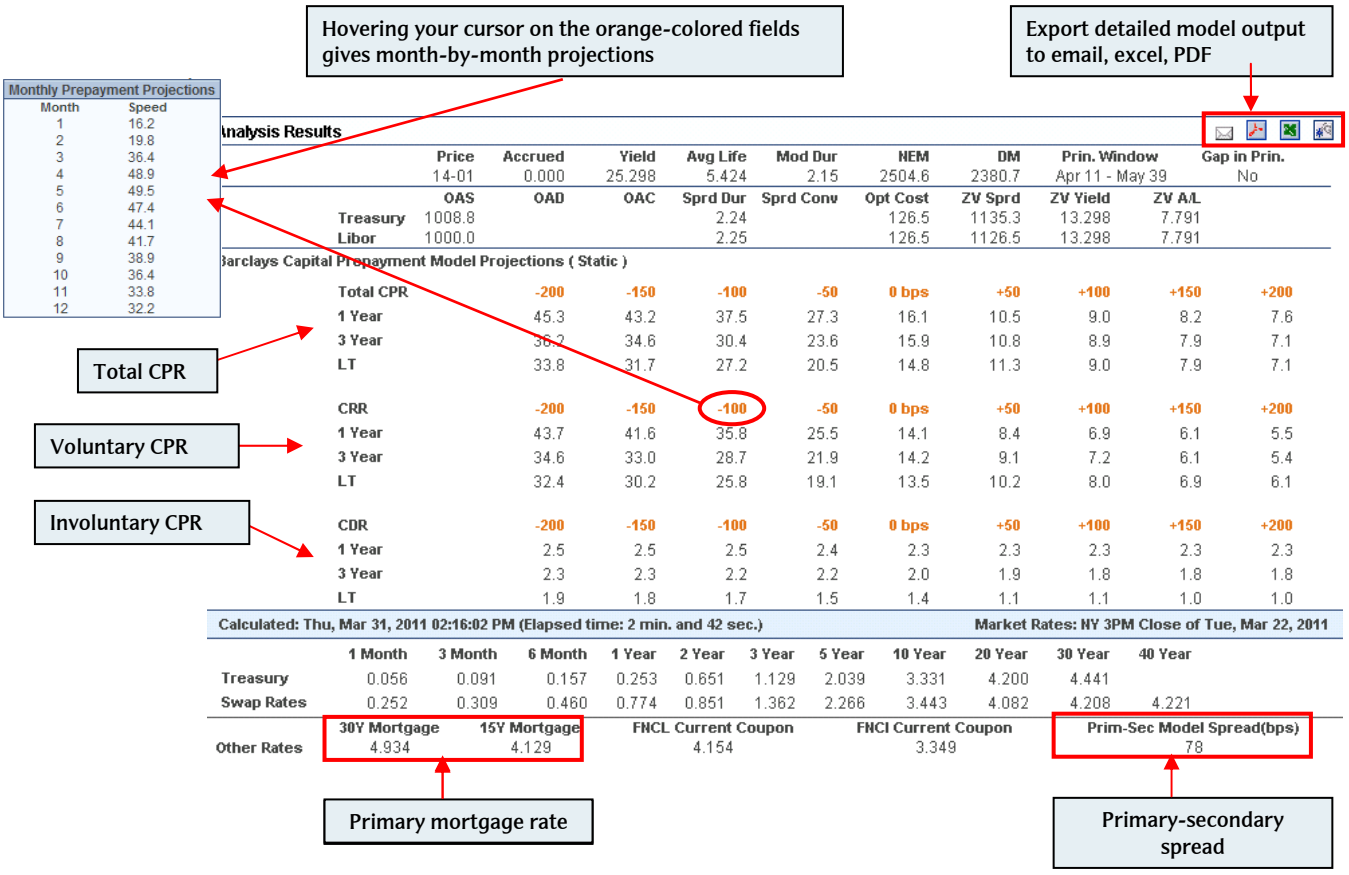
CPR/CDR/CRR break-outs by rate shift – by default, the calculator gives 1y/3y/LT prepayment projections for various rate shift scenarios. Importantly, it not only gives projected total CPRs, but also breaks out the voluntary component (CRR) and involuntary component (CDR) of the total projected prepayments. This can be a useful tool in helping validate the model projections. It is also useful in knobbing specific components of the model to reflect the user's view on prepayments.

Month-by-month prepayment projections – hovering the mouse cursor over any of the rate shifts (highlighted in orange color) gives the month-by-month projections for CPR, CRR, and CDR. This provides another layer of details about how the model handles seasonals, burnouts, mortgage rate lags, HPA path, and underwriting change. For example, users often compare model projections with historical speeds for similar refinancing incentives. However, when doing so it is best to look at monthly projections rather than the 1y CPRs in order to filter out the effect of seasonals, mortgage rate lags, and burnouts.

Mortgage rates and the primary-secondary spread – the calculator also gives the primary mortgage rate estimated as of the pricing date and the assumed primary-secondary spread. These are useful not only for model calibration but also for the user to examine whether the primary-secondary spread is off. Specifically, if the spread is tighter (wider) than actual, the model undervalues (overvalues) IO and premium MBS but overvalues (undervalues) POs and discounts.

Export the model outputs – upon calculation completion the user can click one of the  buttons to export all the model outputs to a PDF or Microsoft Excel file, or to the default email application.

Figure 8: Outputs from the Single Security Analysis



Source: Barclays Capital

Model overrides: Modifying collateral attributes in the calculator

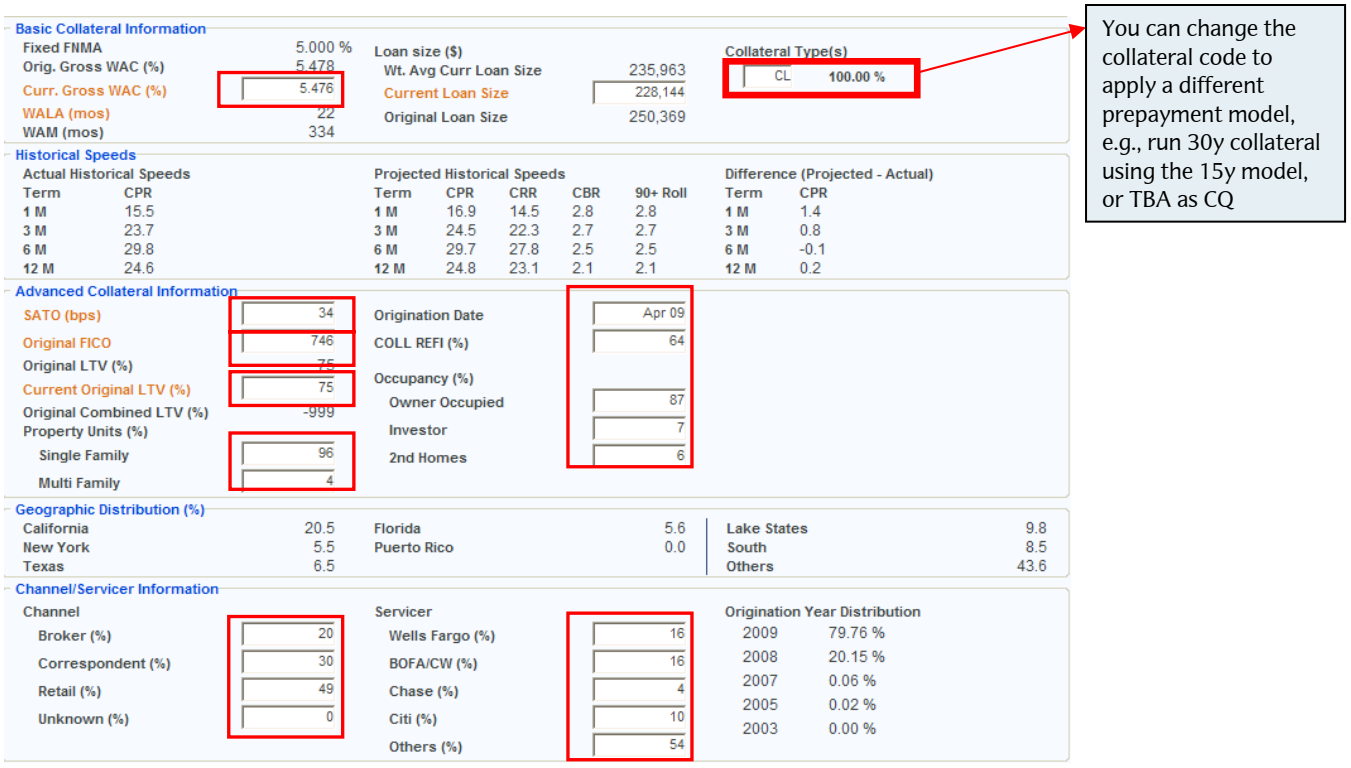
With a security loaded in the SSA, the user can click the Edit button to see all the modifiable collateral attributes (Figure 8) such as WAC, WALA, loan size, SATO, FICO, LTV, %investor, and % refinance. There are a few features that are worth highlighting.

Servicer/TPO/loan type/property type/delinquency pipeline – the calculator allows the user to override the servicer distribution, TPO concentration, and the share of 2-4 unit properties. For GNMA securities, the user can also change percentage of FHA/VA/RHS loans, share of loss-mitigation loans, and the 90day+ delinquency pipeline. Modifying any of these fields could have a meaningful effect on the model projections.

Changing the collateral type – the user can change the prefix of the collateral. For example, changing the prefix from CQ to CL would run FNCQ pools using the prepayment model calibrated for FNCL (30y TBA-eligible) pools. This can be useful, for example, if the user wants to evaluate the effect on FNCQ pools if the HARP program is expanded to allow each loan to refinance through it more than once.

Preserving the dispersion of collateral attributes – the dispersion of the collateral attributes is almost as important as the weighted averages. For example, consider two 75% LTV loans versus a 50% LTV loan and a 100% LTV loan. In both cases, the average LTV is 75% but the prepay behaviours are very different under these two scenarios. Therefore, the calculator tries to preserve the dispersion when the user modifies the collateral attributes. For example, if the average FICO is changed from 720 to 740, the calculator will increase the FICO of each underlining pool by 20 points (as of the publication of this document, this feature is still being implemented for the calculator).

Figure 9: Pricing options in the SSA



Source: Barclays Capital

Model overrides: Prepayment model knobs

Introduction

As detailed in *Inside Mortgage Valuation-A Guide to Models on Barclays Capital Live*, total projected prepayments from the model are the sum of rate/term refinancing, housing turnover, cash-out refinancing and delinquency buyouts, namely:

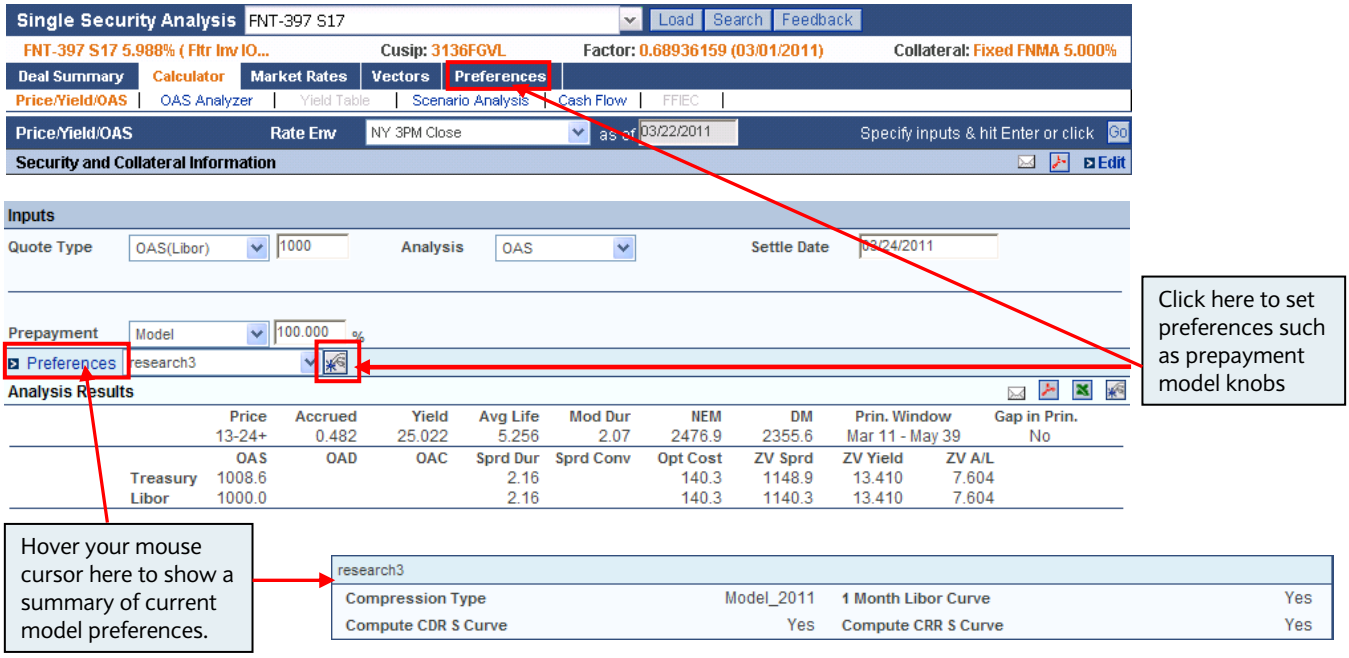
$$SMM = R + T + C + B,$$

where SMM is the total single monthly mortality rate and the R, T, C, and B represent the four separate components. While the prepayment model is carefully calibrated to the last

10+ years of prepayment data and reflects our best estimates of future home prices, underwriting standards, refinancing efficiency, and government policies, it may not fully capture some of the near-term dynamics in prepayments and bond-specific idiosyncrasies and may not agree with the user's own prepayment views. Therefore, a key element of our mortgage valuation analytics is to provide a complete set of knobs that can be used to modify each of the components of the prepayment model. Here are some scenarios in which the user may want to employ the model knobs:

- To reflect a view about the seasoning ramp, housing turnover, shape of the S-curve that is different from the model.
- To correct for bond-specific idiosyncrasies, e.g., pools that have been prepaying consistently faster/slower than the cohort but are unexplainable by collateral characteristics.
- To capture short-term or new patterns that may not be fully reflected by the model, such as esoteric servicer behaviours, early refinancing spike for TPO loans, and short spurs of buyouts.
- To correct for model biases, since the model inevitably produces bigger errors for some types of collateral than the others.
- To reflect the user's own opinion on future prepayment environment such as the path of home prices, underwriting standards, buyout policies, GSE delivery fees and refinancing costs.
- To incorporate new information before it is reflected by the model such as a decrease in the conforming loan size limit, changes to the FHA insurance premiums, and an expansion/extension/expiration to the HARP program.
- To do what-if analysis for evaluating and hedging the prepayment risks of securities.

Figure 10: Accessing the model preferences in the Single Security Analysis



Source: Barclays Capital

To access the prepayment model knobs, the user can click either the Preferences tab or the button, as shown in Figure 10. To see a summary of the current settings of the model preferences, the user can hover the cursor over Preferences .

Once in the preference page (Figure 11), the user can click ? to see the definitions and examples of the model knobs. For most of the knobs, there is an empty field next to it which signals that the user can input a constant value. For example, setting *CRR Mult* to 2 will double the model projected voluntary prepayments (in SMM terms). For many of the knobs, there is also a Vector button which signals that the user can click to choose one of the pre-defined vector knobs. To define and save vectors, the user can click the Vectors tab on the top of the screen (Figure 11).

Overview of the prepayment model knobs

Figure 12 gives a summary of the prepayment model knobs. Overall, there are four types:

- **Basic knobs** – most of these are either a multiplier or addition to various components of the prepayment model. For example, setting the *CDR Mult* knob to 1.1 increases projected involuntary prepayments (in SMM term) by 10%, while setting it to a value of 0.9 decreases them by 10%. On the other hand, setting the *CDR Add* knob to 2 increases involuntary prepayments along every interest rate path by 2 CPR (in SMM terms), while setting it to -2 decreases them by 2 CPR. By using a vector knob, the user can apply a different knob value either at different future time points or at different WALA.

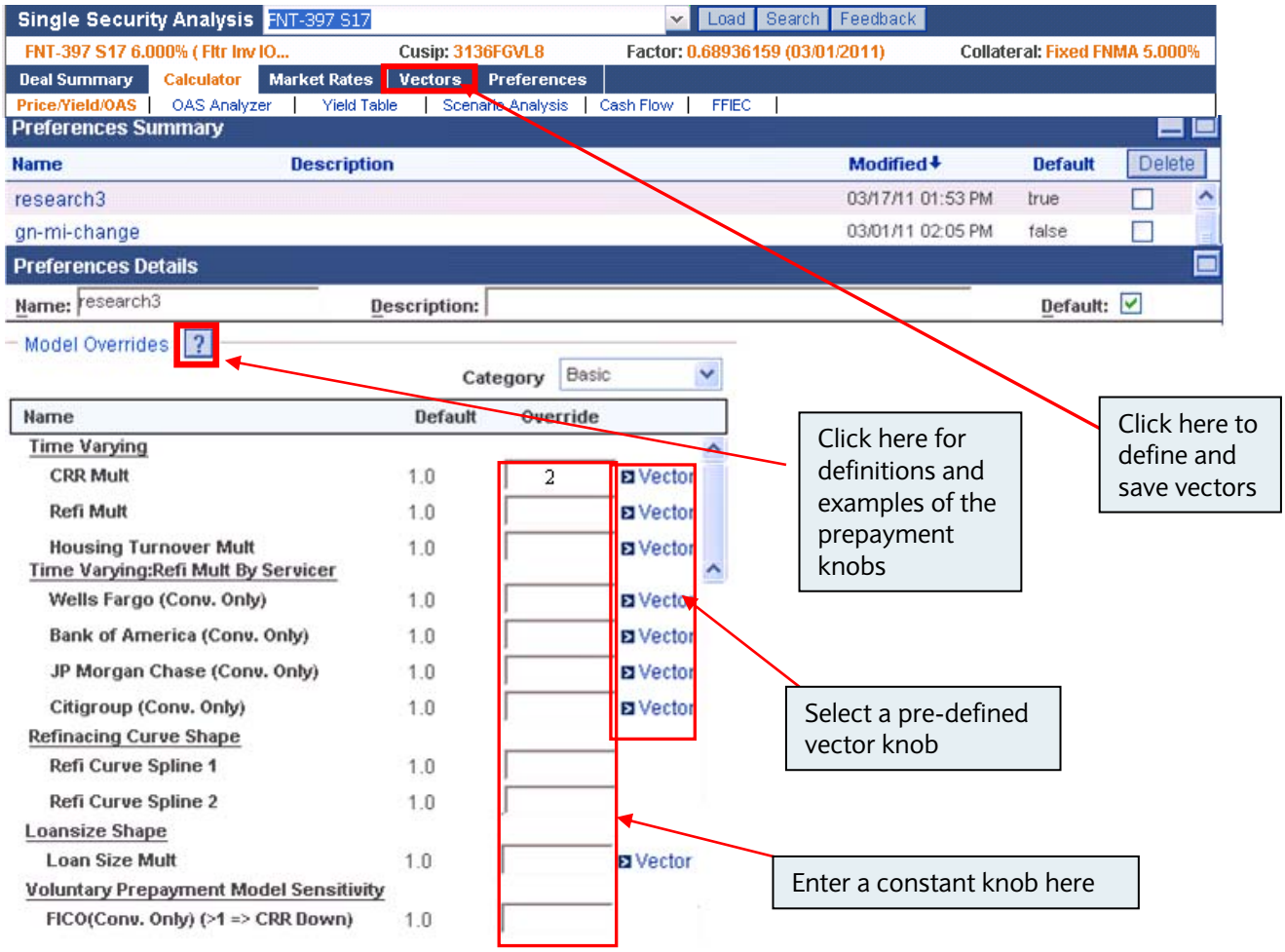
  Other knobs in this category either directly shift the shape of the S-curve or modify collateral characteristics. For example, setting the *SATO Add (CRR Model Only)* knob to 25 increases the SATO of the collateral by 25bp and thus decreases projected voluntary prepayments. While the same effect can be achieved by modifying the SATO field on the calculator screen, with this knob the user can apply a time-varying vector. The *Elbow shift (bp)* knob adjusts projected mortgage rates used for refinancing incentive calculation. Setting it to 25 increases all projected mortgage rates by 25bp, and thus decreases refinancing speeds.

- **Knobs for the voluntary prepayment model sensitivity** – rather than applying simple scalars or additions to projected speeds (as is the case for the basic knobs), these knobs adjust the sensitivity of voluntary prepayment to various attributes. For example, setting the *Burnout Effect* to 1.10 increases the burnout rate by 10% and decreases projected voluntary speeds, while the *Refi Curve Spline* knobs allow the user to fine tune the shape of the S-curve by knobbing any of the eight spline sections. The *Loan Size Mult* knob adjusts the gradient of the loan size effect on refinancing, while *Refi Mult By Orig. Vintage* allows applying different refinancing multipliers to different vintages (down to monthly originations). Other model sensitivities that can be modified with the knobs include the GEO effects, servicer effects, and FICO, LTV and SATO effects.

- **Knobs for the involuntary prepayment model sensitivity** – these knobs are similar to those described above except that they affect the involuntary component of the model. For example, setting the *FICO (Conv. Only, <720)* knob to a value > 1 increases the projected involuntary speeds for pools with a FICO < 720, while setting the *ULTV (<80)* knob to a value > 1 decreases the involuntary speeds for pools with updated LTV < 80%. The *Mult By Orig. Vintage* knob can apply different CDR multipliers to different months/years of originations, while *SATO* adjusts the effect of SATO on projected involuntary speeds.

- **Knobs for environmental variables** – declining home prices, underwriting standards changes and government policies have been significant drivers of prepayments over the past few years and will likely remain so for the foreseeable future. By default, the model reflects our base-case views about the future prepayment environment but several knobs can be used to adjust these assumptions to reflect the user's own views. For example, the *Avg FICO GSE* knob specifies the average FICO of FNMA 30y production, which is an indicator of underwriting conditions. Intuitively, a higher production FICO signals tighter underwriting, while a lower FICO signals easier credit. As of Q4 2010, the average FNMA production FICO was at about 760 (compared with a historical average of 720) and the model assumes it will remain at 760. However, the user can knob this using a vector that decreases in value over time to reflect a view that underwriting will ease at some point in the future. Doing so would boost projected voluntary prepayments.

Figure 11: Prepayment model knobs



Source: Barclays Capital

Similarly, the user can adjust fixed refinancing costs higher/lower over time, or turn on/off the effect of the GSE delivery fees. Both will affect projected refinancing speeds. There are also knobs for home price paths at the regional or national level (more details on this in the next section). The user can also change the lag between prepayments and mortgage rates.

By default, the model assumes that the lag is about six weeks for conventional loans and shorter for GNMA loans. The user can modify this by setting the *Refi Incentive Lag* knobs.

There is also a set of knobs specifically designed for the HARP program. A major reason for the much slower speeds on post-HARP originations is that a lot of these loans came through the HARP channel with reduced documentation, sub-standard mortgage insurance, and waived full appraisal. Because they can not refinance through the HARP program again and do not qualify for standard underwriting either, they prepay much slower. The *Refi Loan after HARP End date* knob is designed specifically for this effect. A value > 1 increases this effect and further dampens projected speeds on post-HARP origination. Furthermore, by default, the model assumes that HARP never expires. However, the user can specify an expiration date with the *HARP End Date* knob. Similarly, the model assumes that HARP eligibility is constrained to loans originated up to May 2009 for both Fannie and Freddie. The user can change this by using the *HARP Eligibility End Date* knobs.

Figure 12: Overview of the prepayment model knobs

Basic model knobs	
• CRR multiplier	• CRR addition
• Refinance function multiplier	• PSA addition
• Cash-out function multiplier	• CDR addition
• Housing turnover multiplier	• SATO addition
• CDR multiplier	• Elbow shift
Knobs for the voluntary prepayment sensitivity:	
• Servicer	• Loan size
• Vintage	• Specific portion of the S-curve
• FICO	• SATO
• LTV	• Burnout
• Geographical distribution	
Knobs for the involuntary prepayment sensitivity:	
• FICO	• SATO
• LTV	• Vintage
Knobs for environmental variables	
• Average FICO of GSE originations	• Fixed refinancing cost
• HPA	• GSE Delivery fees
• HARP eligibility/expiration dates	• Mortgage rate lags

Source: Barclays Capital

Knobs for housing turnover

Housing turnover in the model can be interpreted as:

HT= pure HT + lock-in effect + recent HPA effect + seasonality.

We provide knobs for adjusting each of these components except the seasonality. The most straight forward way to adjust housing turnover is to set the *Housing Turnover Mult* knob. For example, a constant value of 0.75 would reduce the model turnover rate by 25% in SMM terms. If users believe that turnover will be lower than the model for the first few years then turn faster than the model, they can use a time-varying vector for this knob. Similarly, one can lengthen or shorten the seasoning ramp of turnover with a vector.

Rather than using a multiplier, the user can also use the *CRR Add* and *PSA Add* knobs to add a constant or a vector to the housing turnover model. Other knobs that can be used to

affect housing turnover include the HPA knob, the elbow shift knob (which affects the lock-in effect), and the GEO knob. Modifying collateral characteristics can also affect housing turnover. For example, a change in WALA, LTV, WAC, GEO distribution, and FHA/VA/RHS concentration can all affect model-projected housing turnover.

Knobs for rate/term refinancing

We define economic incentive (EI) for refinancing as the percentage change in monthly payment assuming the borrower refinances into another loan with similar maturity at the prevailing mortgage rate. The balance and prevailing rates are adjusted for well-defined factors such as delivery fees, origination costs and, in the case of FHA mortgages, the structure of mortgage insurance premiums. The refinancing response function (S-curve) is parameterized as a piece-wise linear function of EI where we allow factors such as SATO, loan size, FICO, and ULTV to affect the slopes of each section of the spline. This highly flexible form allows collateral attributes, home prices, and other factors to change not only the level, but also the shape of the refinancing function.

Because rate/term refinancing typically accounts for the majority of prepayment variability, more than half of the model knobs are designed for this component. The most straightforward way is to use the *CRR Mult* or *Refi Mult* knob. The difference between these two is that the former applies to all the voluntary speed components including rate/term refinancing, cash-outs, and housing turnover, while the latter only applies to rate/term refinancing. For example, to lengthen/shorten the refinancing seasoning ramp, one can use a time-varying *Refi Mult* knob. Two other commonly used knobs are the elbow shift and SATO shift, which take both constant values or time-varying vectors.

As discussed earlier, there is also a wide range of knobs for adjusting the model sensitivity to a variety of factors. As mentioned earlier, the user can knob the gradient of refinancing efficiency to loan size, FICO, LTV, and SATO, or apply a multiplier to a specific servicer or origination month/year. For example, to reduce the projected refinancing speeds for loans smaller than $150k but increase those bigger than $150k, the user can set the *Loan Size Mult knob* to something like {[(0, 0.5), (150000, 1), (729000, 1.1)], Phase_In=Interpolated}. If the user does not agree with the modelled GEO effect on refinancing, he can turn this effect off by setting the *Turn Off Geo Effects* knob to 1.

The user can also fine tune the shape of the S-curve by adjusting the eight knot points of the model S-curve. Specifically, the EI for refinancing is defined as the ratio between the monthly payments of the current loan and the refinanced loan assuming prevailing mortgage rates and refinancing costs. The S-curve has eight knot points in terms of EI—0.97, 1.00, 1.03, 1.06, 1.09, 1.12, 1.15, 1.20, 1.25—and each of them can be adjusted separately. For example, setting the *Refi Curve Spline 3* to a value > 1 steepens the specific portion of the S-curve where the EI is between 1.03 and 1.06, while a value <1 flattens this section. Consequently, a value > 1 for this knob leads to faster speeds for all EI > 1.03, while a value <1 decreases them.

There are also several knob-able environmental variables that can have a significant effect on refinancing speeds. As discussed earlier, reducing *Avg FICO GSE* will increase projected refinancing speeds. Similarly, an increase in *US HPA* or a decrease in *Fixed Refinancing cost multiple* will also lead to higher projected refinancing speeds. All these knobs take time-varying values, which can be used to reflect a specific trajectory of the future prepayment environment. If users believe that the GSE delivery fees will be eliminated at some time in the future, they can put *Set all delivery fees to zero* at 1. The HARP-related knobs are

capable of fine tuning the speed differential between pre- and post-HARP originations, and allow the user to analyze various HARP extension/expansion/expiration scenarios.

Finally, the user can also modify the collateral characteristics to change projected refinancing speeds. Almost all modifiable attributes will affect refinancing, including the collateral prefix, WAC, WALA, loan size, SATO, FICO, LTV, %refinance loans, %loss mitigation (for GNMA only), %TPO, servicer distribution, %investor, %single-unit, and %FHA/VA/RHS. Changing the collateral aggregation scheme or the primary-secondary spread assumption (more on these in the next section) will also affect projected refinancing speeds.

Knobs for cash-outs

In the model, cash-outs encompass all prepayment transactions where the motivation of borrowers is to tap the equity locked in their property. This is generally achieved by either using the equity in the property to trade-up or by refinancing the existing mortgage to a higher LTV loan. We model cash-out refinances as a function of the weighted cumulative home price appreciation of the pool. We apply a discount factor such that any appreciation that happened more than three years in the past is significantly less important than recent appreciation. For a given level of HPA, the propensity to cash out depends on the level of mortgage rates and the credit quality (FICO and SATO) of the borrower since weaker credit borrowers have a higher tendency to tap the equity and the likelihood of cash-outs diminishes quickly if the borrower has a below market rate on the current mortgage.

The simplest way to adjust the cash-out component is to use the *Cashout Mult* knob. For example, setting this knob to 1.25 would increase the projected cash-outs by 25% (in SMM terms). Furthermore, any model override (either by modifying the collateral characteristics or using the prepayment model knobs) that changes mortgage rates (such as elbow shifts, WAC, primary-secondary spreads), credit quality (FICO and SATO), or HPA paths would also affect model projected cash-outs. However, most of these model overrides also affect projected rate/term refinancing, and because cash-out in the model is a much smaller component than refinancing, using these knobs for cash-outs could have some unintended consequences.

Knobs for involuntary prepayments

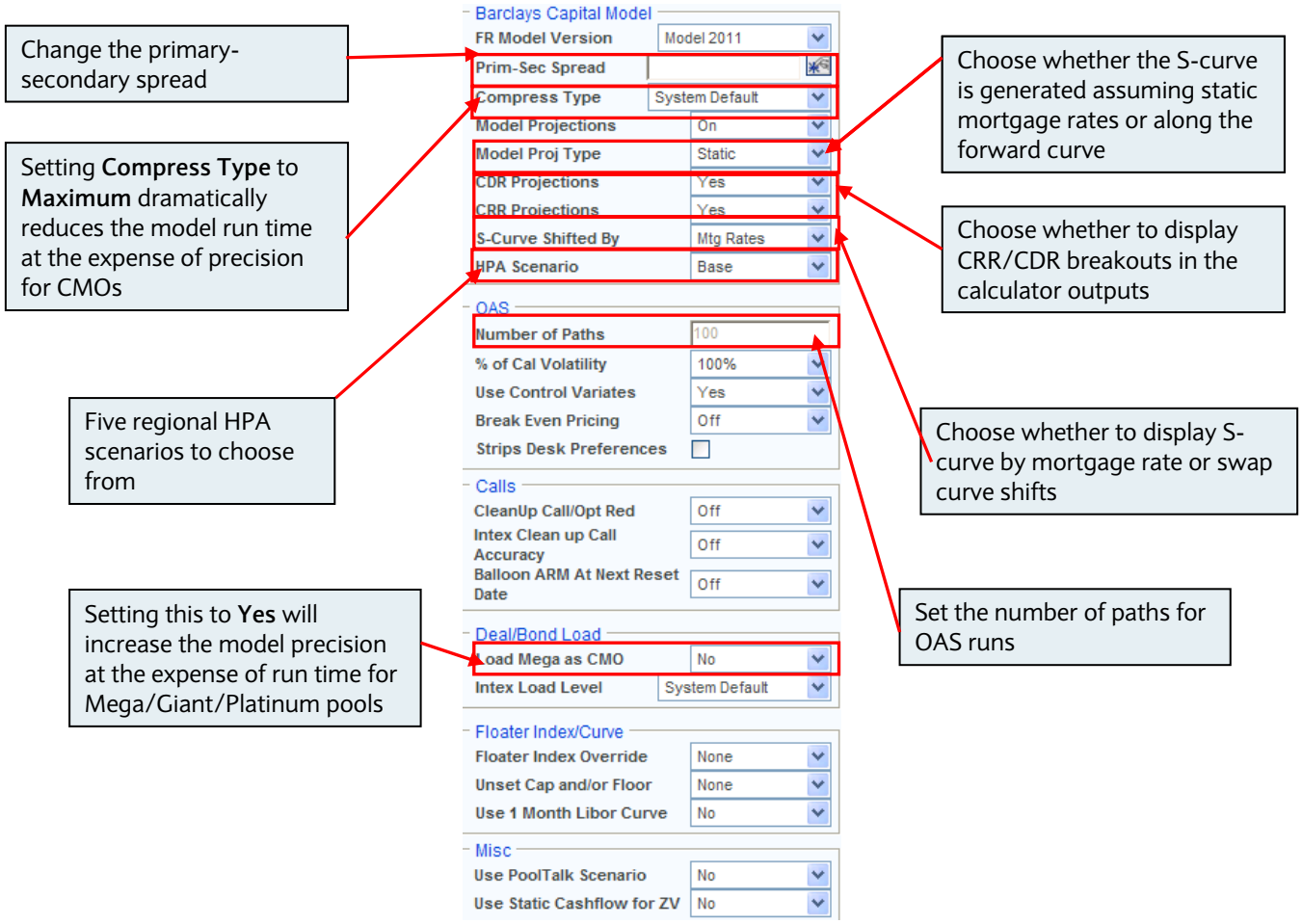
The severe deterioration in credit performance over the past few years has substantially increased the contribution of buyouts to overall agency prepayments. Consequently, we have expanded the capability for users to adjust this component in the model. In our framework we use the terms "buyouts," "involuntary prepayments" and "CDR" synonymously, and the most straightforward way to adjust this component is using the *CDR mult* knob. For example, setting this knob to {[(WALA=1, 2), (WALA=24, 1)], Phase_In=Interpolated} would increase the projected involuntary speeds by 0-100% for collateral less than 24 WALA.

Alternatively, one can use the *CDR Add* to add either a constant or a time-varying value to each projected prepayment path in the model. For this purpose the *CRR Add* knob accomplishes exactly the same thing as *CDR Add*. One scenario in which this can be very useful is to simulate a one-time spike in buyout activity, such as those by Fannie and Freddie in early 2010 and the servicer-specific buyout spikes in the GNMA space. For example, if one assumes that 10% of the UPB will be bought out three months from now, he can set the *CRR Add* or *CDR Add* knob to {[(Months_Ahead=3, 72)} since 10% buyout corresponds to 72 CPR. The *PSA Add* knob is similar except that it assumes an explicit PSA ramp.

As mentioned earlier, the calculator also has several knobs for adjusting the gradient of involuntary speeds to LTV, SATO, and FICO. By using a vector, the user can even apply origination month/year specific multipliers to the CDR component. Since the path of home prices is an important input to the involuntary prepayment model, setting the HPA knobs will affect projected CDRs as well.

Finally, the user can modify the collateral characteristics to change projected involuntary prepayments. Several of the modifiable fields, such as the collateral prefix, WAC, origination date, WALA, SATO, FICO, LTV, and %investor, have a material effect on the model CDRs. The caveat is that changing these attributes will likely affect projected voluntary speeds as well. For GNMA securities, we have found refinance loans to have worse credit performance than otherwise-the-same purchase loans. As a result, modifying the %refinance field will significantly change projected CDRs. Similarly, the percentage of loans that have been previously modified and the 90day+ delinquency rate are also important inputs to the GNMA CDR model, and modifying these attributes will affect projected CDRs as well.

Figure 13: Setting preferences in the Single Security Analysis



Source: Barclays Capital

Model overrides: Setting preferences in the calculator

Besides modifying the collateral characteristics and knobbing the prepayment model, the user can also customize other aspects of the calculator such as the primary-secondary spread and how the underling collateral is aggregated before feeding into the prepayment model. These are useful not only for tuning the calculator to specific needs of a user but also for calibrating the various components of the model (e.g., prepayment, primary-secondary spread, volatility). To access these preferences, the user can click either the Preferences tab at the top of the calculator screen or the button, as shown in Figure 10. To see a summary of the current settings of the calculator, the user can hover the cursor over Preferences. Some commonly used preferences consist of the following:

- **Primary-secondary spread** – The calculator has a sub-model, which estimates the primary-secondary spread as a function of the level of 2y and 10y swap rates and rate attractiveness (for details of this model please refer to *Inside Mortgage Valuation-A Guide to Models on Barclays Capital Live*). However, if the user does not agree with the outputs of the model (Figure 8) or wants to neutralize the effect of the primary-secondary spread changes while running the calculator, he can either enter a fixed value or a time-varying vector for this preference.

- **Compression type** – To increase precision while reducing runtime, we aggregate pools backing CMOs by the most important drivers of the prepayment model:

  - Collateral prefix – different types of collateral are never aggregated
  - Origination date – which has significant implications about HARP eligibility for conventional loans and mortgage insurance structure for FHA loans
  - WAC, WALA, Loan Size, SATO, FICO, and LTV – these are among the most important collateral attributes that drive the prepayment model

  While aggregating the collateral, if any bucket has less that 1% of the outstanding collateral balance we roll the bucket into the neighbouring bucket with the lowest balance. This ensures that no CMO will have more than 100 representative buckets (the only exception is re-remics). As a result, we are able to generate fast OAS calculations without sacrificing pricing precision, even when running CMOs backed by thousands of pools.

  However, if there is ever a need to further reduce the number of buckets run and minimize calculation time, the user can set *Compress Type* to Maximum. This dramatically reduces the model run time at the expense of precision for CMOs.

- **Load Mega pools as CMO** – by default, the model runs a Mega/Giant/Platinum pool as if it is a simple pool, namely, by feeding the weighted average WAC, WALA, origination date, loan size, FICO, LTV into the prepayment model. However, the user can choose to run Mega/Giant/Platinum pools as CMOs, in which case the collateral backing the pool is first bucketed using the aggregation scheme as discussed above before each bucket is run through the prepayment model separately.

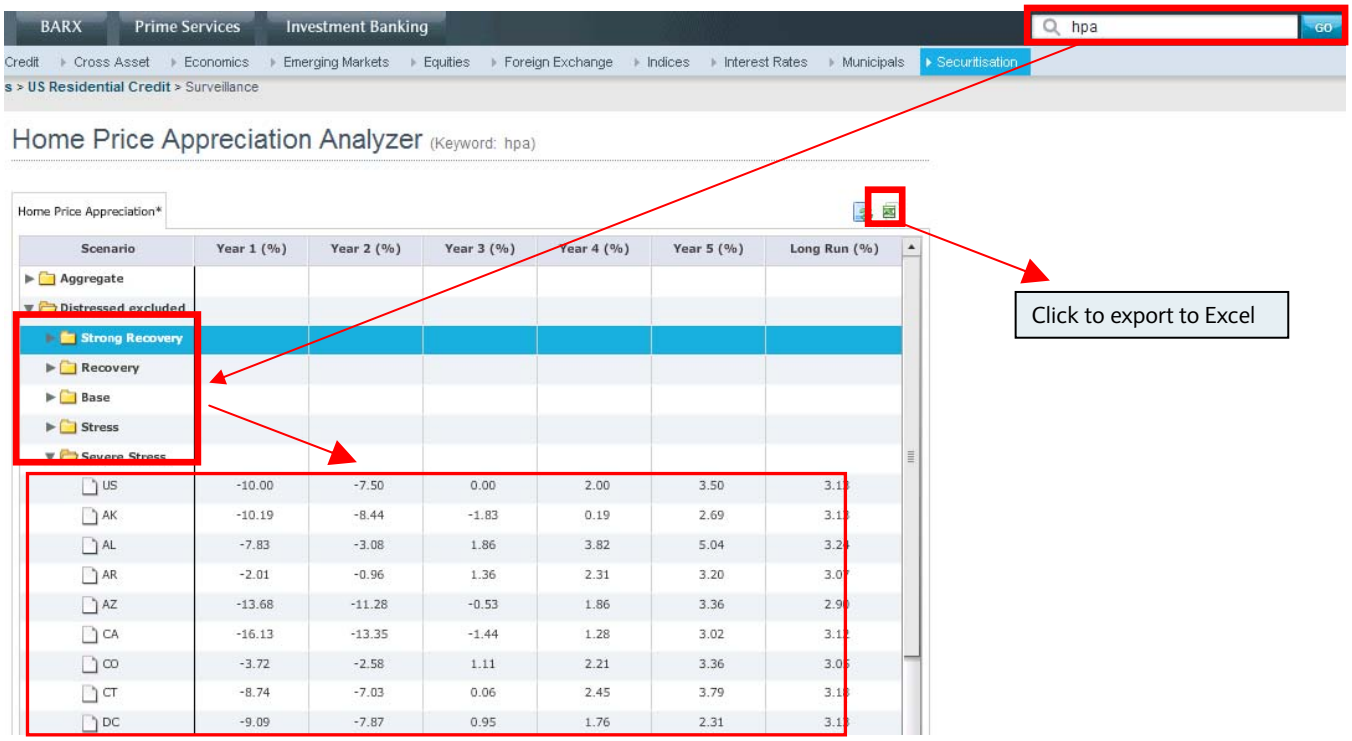
- **CDR/CRR break-outs** – by default, the S-curve shown on the calculator output page gives projected 1y/3y/LT CPR/CRR/CDRs (Figure 8). However, the user can specify whether to show CPR only, or to show the CRR/CDR breakouts. Showing the breakouts increases the model run time slightly.

- **Generating the S-curve using static rates or along the forward curve** – by default, the S-curves displayed in the model outputs (Figure 8) are generated by shifting the primary mortgage rate instantly and holding it constant forever. However, the user can choose to generate the S-curves along the forward curve with the forward mortgage rates derived from the primary-secondary spread model.
- **Generating the S-curve by shifting mortgage rates or swap rates** – by default, the S-curves displayed in the model outputs (Figure 8) are generated by shifting the primary mortgage rate instantly and holding it constant forever. However, the user can specify to have the S-curve generated by parallel shifting the swap curve. In that case, the model will first estimate the primary-secondary spread path for each rate-shift scenario before feeding it into the prepayment model.
- **Five regional HPA scenarios to choose from** – the calculator has five pre-defined scenarios for regional home price paths. Reflecting different levels of housing strength, they are named Severe Stress, Stress, Base, Recovery, and Strong Recovery. In the next section, we give the details of each of these five scenarios. By default, the Base case is used for all model runs but the user can choose any of the five scenarios. Note that among the prepayment model knobs there is also a *US HPA* knob. When this knob is used, it supersedes the regional home price scenarios and sets the HPA path of every state in the US to be the same as the US national HPA path.

The Home Price Appreciation Analyzer

Almost any valuation of securitized products depends on some assumptions about home price paths. Consequently, in tandem with the release of our new prepayment model, we have also updated our home price model. Details about the model construct and outputs can be found in *Inside Mortgage Valuation-A Guide to Models on Barclays Capital Live*, but at the highest level, we use CoreLogic distressed excluded, state level home price indices to calculate updated LTV for each pool and to project forward HPA paths. We think the distressed excluded indices, which eliminate transactions involving short sales or foreclosure sales, are a better representation of the prices of properties underlining agency MBS. On Barclays Capital Live, one can bring up the Home Price Appreciation Analyzer by typing the keyword "HPA" into the search field in the upper right corner of the screen (Figure 14).

Figure 14: The Home Price Appreciation Analyzer



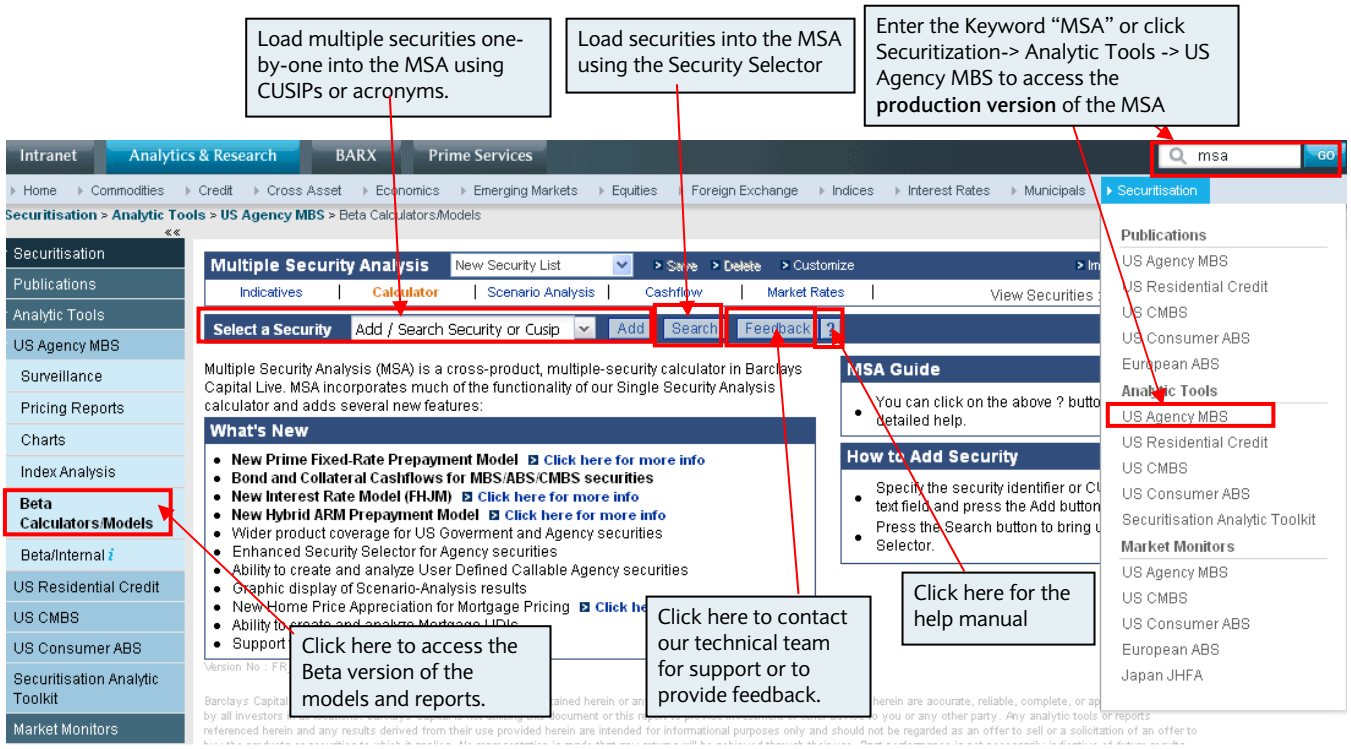
Source: Barclays Capital

Once in the HPA analyzer, the user can click on the left hand side to view either the distressed-excluded or the aggregate series. The difference between these two series is that the aggregate series include short-sales and foreclosure sales while the distressed-excluded do not. For each of the two series, the user can choose to view one of five pre-defined model projections for state-level home prices. Reflecting different levels of housing strengths, these five scenarios are named Strong Recovery, Recovery, Base, Stress, and Severe Stress. Clicking on each of the five scenarios gives a year-by-year state-by-state matrix of projected future HPA paths benchmarked to the CoreLogic home price indices. After viewing the projections, the user can click the button at the upper right corner to export all of them into a Microsoft excel file.

The Multiple Security Analysis

While the Single Security Analysis allows a user to review and fine tune the details of the collateral and model, another equally useful calculator, the Multiple Security Analysis (MSA), allows one to run many securities at once. Essentially, the MSA is a portal through which the user can load a list of securities to run either one at a time or all at once. Notably, the user can choose separate pricing options and model preferences for each individual security, and can obtain projected cash flows for each security as well as for the entire portfolio.

Figure 15: Accessing the Multiple Security Analysis

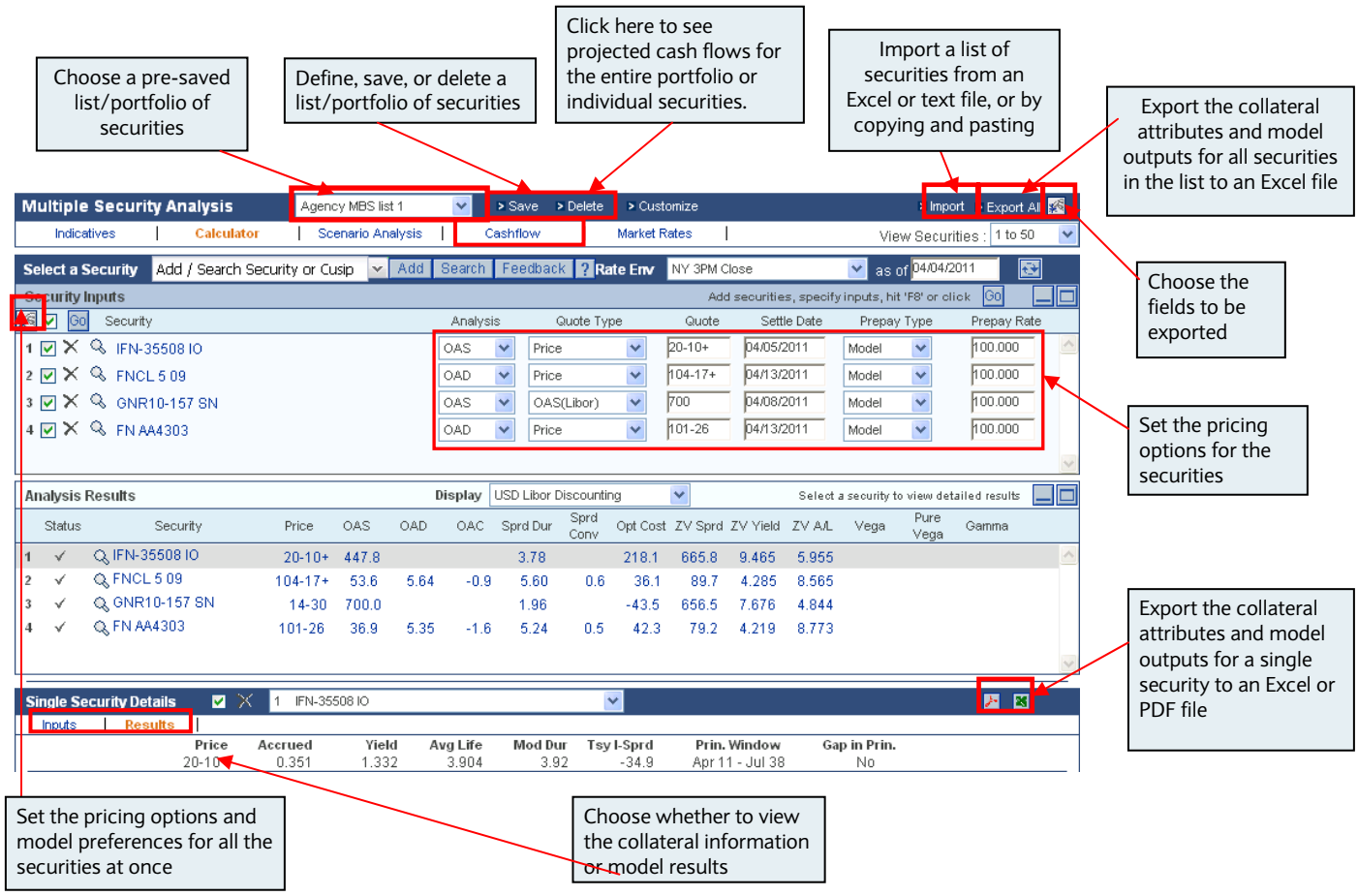


Source: Barclays Capital

To access the MSA, the user can type the keyword ''MSA" into the search field at the upper right corner of the screen (Figure 15). If there is a Beta version of the model, the user can access it by clicking the Beta Calculators/Models link on the left-hand side panel. Once in the MSA, the user can start adding securities one by one. Same as in the SSA, securities can be added by either typing in the CUSIPs or acronyms (Figure 3) or by using the Security Selector by clicking Search.

Figure 16 shows how the MSA looks after a list of securities have been loaded. The user can set the pricing options for each security individually, or click the button to set the prices and model preferences for all at once. To save the current portfolio of securities for later use or to delete a previously saved list, the user can use the Save Delete buttons. Once the securities are loaded and pricing is set, the user can click the Go button to run the calculator. Upon completion, the user can toggle between the Inputs | Results buttons to review either the security information or the model results for any security in the list. If the user is interested in the month-by-month projected cash flows, he can click the Cashflow tab. Here, he can look at the projected cash flows for either an individual security or for the entire portfolio. If the user wants to export the security information and model outputs to a Microsoft Excel or PDF file, he can either click to export the selected security or click Export All to export all the securities at once.

Figure 16: Basic functions of the Multiple Security Analysis



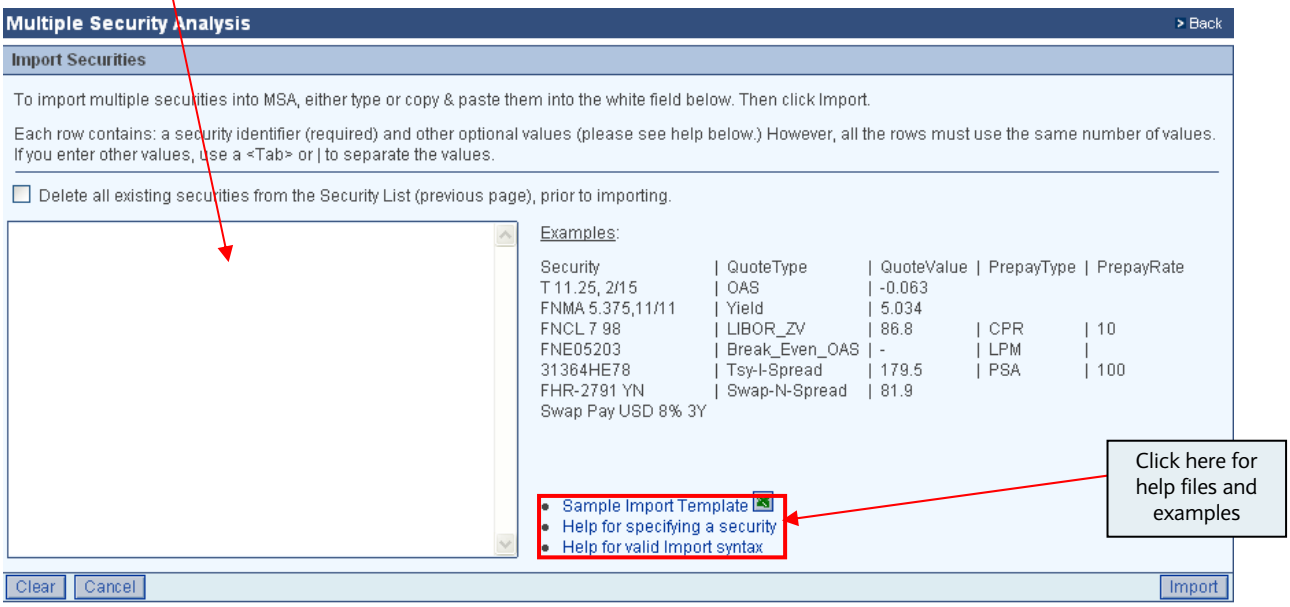
Source: Barclays Capital

Another way to add securities in bulk is to compile a list outside of the calculator and copy and paste it into the MSA. For most users, this method is easier to use and provides more flexibility than adding securities one by one. To use this function, compile a list of securities with pricing and model preferences using a text editor or Microsoft Excel, just as the example shown in Figure 17. Then click Import to bring up the import screen. There, the user can copy and paste the list into the text box and click Import to load. For more examples on how to use the import function, the user can refer to the help files on the screen.

Figure 17: Importing a list of securities into Multiple Security Analysis

Compile your list of securities and set the pricing options and model preferences, just like this example, then copy and paste into the box below. Click **Import** to load into the MSA

Security	Analysis	QuoteType	QuoteValue	PrepayType	PrepayRate	Preferences
FNCL 5 TBA	OAS	LIBOR_OAS	28	Model	100	Elbow_Shift_25bp
FNCL 4.5 09	Static	LIBOR_OAS	41	CPR	9	1.25xRefi
FNCQ 5 10	ZV	Yield	4.26	PSA	200	0.9xCDR
FNR04-36 SA	OAD	LIBOR_ZV	900	Model	85	
FHR-3072 SG	KRD	Price	17-06	CPR	17	
GNR10-114 NS	Parital Dur	LIBOR_OAS	700	Model	120	1.24xCDR
intex:ZFH3680G2X MA	OAS	Spread_to_Treasury	95	Model	250	
FNT-397 2	Static	Price	23-03	CPR	15.4	
IFN-34509 IO	ZV	LIBOR_ZV	557	Model	100	HARP_Expire
FH A29561	OAD	Yield	3.48	Model	100	
FN AE6396	KRD	Spread_to_Treasury	116	Model	85	Stress_HPA



Click here for help files and examples

Source: Barclays Capital

Analyst Certification(s)

We, Derek Chen and Shweta Kapadia, hereby certify (1) that the views expressed in this research report accurately reflect our personal views about any or all of the subject securities or issuers referred to in this research report and (2) no part of our compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this research report.

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