



# MIAC Perspectives

July 2010



## Sharpening Focus on a 'Peek-a-Boo' Recovery

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## In this Issue:

**I**n this Summer Issue of *Perspectives*, we take a close look at a market still in turmoil, while examining some of the excellent tools available to help you survive in a rapidly evolving market. Whether or not and how fast the market is improving seems to depend more on one's personal outlook than the churning statistics and peaks and valleys of the recovery. In short, 'now you see it, now you don't.'

As Congress works its magic on reconciling House and Senate versions of financial legislation reform, promised for Presidential signature within a few weeks, federal agencies form and collapse on paper almost instantly, while banking impacts large and small weigh in the balance. What lies ahead is a murky picture at best. But as always, MIAC offers a sound synopsis and expert opinions on where we are NOW and where we are headed.

In our first article, *MIAC's Software Suite: Significantly Expanded and Enhanced*, Lisa Malie, Senior Vice President, Product Management, provides an explanation of how MIAC has enhanced its suite of essential software to accommodate a volatile market. As always, our focus has been on providing you, our customers, with expanded capabilities, improved integration and, of course, transparency and control. Find out how we've improved these already critical tools and how they can help you in an ever changing market.

In *State of the Commercial Real Estate Lending Markets*, Dean Hurley, Senior Vice President, Capital Markets, examines the conflicting perspectives on the commercial real estate lending recovery in the offing and provides an insider's view to what really lies ahead.

*Making Sure You Have the Right Model – And That Your Model is Right*, by Alexander Samuel, Vice President, Capital Markets, provides an insightful and easily understood guide to determining how best to evaluate your models and their performance. In his insightful article, Alex explains, among other topics: the purpose of

model testing; the difference between model verification and validation; industry best practices; and how MIAC goes about the verification and validation process to ensure our tools are reliable, accurate and up-to-date.

Dan Thomas, Managing Director, provides a very current and transaction rich look at the commercial servicing market in his article: *Commercial Servicing Market Update*. In this article, Dan profiles both current deals and market values for those who need to know how this market is performing, complete with an outlook for 2010 and beyond.

For those who keep a finger on the residential MSR market, Mike Carnes, Vice President of Capital Markets, provides a compelling look at the current residential market in his *Residential MSR Market Update*. Find out why firms should be cautious about trying to support particular values before taking into consideration often overlooked performance matrices, and also why we currently find ourselves in one of the best buyer markets in history.

Finally, we round out this issue with an in depth, insightful look at *MIAC's Constant Maturity Mortgage Calculator* by Edmund Li, Vice President, Financial Engineering. During the past decade, CMM products (constant maturity mortgage forward and constant maturity mortgage swap) have emerged in the mortgage market as very effective hedging instruments, especially in the servicing hedging area. Edmund's article explains in detail how these instruments work and how MIAC has integrated the Constant Maturity Mortgage Calculator into our ALM Suite to benefit our customers.

Providing our clients with the best tools and comprehensive market knowledge they require to be successful is MIAC's mandate. This issue of *Perspectives* continues that commitment. We trust this selection of articles provides needed focus on a clouded economic horizon. As always, we welcome your feedback.

David McCraw, Perspectives Editor



By Lisa Malie, SVP  
Product Management

## MIAC's Software Suite Expanded and Enhanced

**O**ver the past three years, the mortgage market and financial markets in general have been in turmoil. After years of rising house prices, diminishing credit quality, and increasing leverage, the money train came to a screeching halt, leaving no player in the market untouched in some way – not banks, not mortgage companies, not government sponsored entities, not companies like MIAC that support the mortgage market with products and services, not even the average American citizen.

It was during this time of uncertainty that MIAC launched its most recent effort to upgrade all of its software product offerings. This was no small undertaking, given the upheaval across all financial markets. While so many financial institutions turned a blind eye to the underlying risks in the market, MIAC was dealing with those risks every day as we worked with our clients to value the full range of mortgage assets – loans, servicing, bonds, etc. It was this first-hand experience, in the trenches with both our software and consulting clients, which drove our software upgrade priorities.

### Expanded Modeling Capabilities

**A**s is evidenced by the changes we have witnessed in the mortgage market over the past several years, it is critical that our financial models and data tools evolve as well. The most updated release of the MIAC *Analytics* applications incorporates a host of additional features giving our users expanded modeling capabilities across the valuation spectrum.

As we read in the news every day, mortgage defaults are on the rise across the board (see Mike Carnes article “Residential MSR Market Update”

in this issue of perspectives). The valuation implications of this environment are significant. Many of the model enhancements incorporated into WinOAS™ Version 4.1 SP3 are specifically geared toward capturing these impacts. From broadening our default curve options to expanding our default-related cost and advance parameters, this new release gives users greater flexibility in capturing the key default-related behaviors and resulting costs.

Originators, servicers, and investors continue to grapple with the impacts of this diminishing performance. In response, there has been increased focus throughout the market on both providing assistance to borrowers through loan modifications and forcing originators to take back loans through stricter enforcement of rep and warranty provisions. The economic impact of both of these industry dynamics is very real, and WinOAS 4.1 SP3 provides the framework for modeling this impact.

In early 2009, the Homeowner Affordability and Stability Plan was announced. As part of that plan, the Home Affordable Modification Program (HAMP) was detailed as a way to help keep homeowners in their homes and out of foreclosure. As part of this program, there are specific cash flows, payable by the federal government, which are potentially available to servicers, lenders, and borrowers. In WinOAS 4.1 SP3, users have the ability to model these cash flows consistent with the HAMP program. Further, the Loan Modification Model provides flexibility to allow users to model other modification programs as well. Additionally, MIAC incorporated the modification decision process, as specified in HAMP, into DataRaptor® Version 4.2. This logic can be made available to clients on a case by case basis.

For reps and warrants, WinOAS 4.1 SP3 includes a Rep & Warranty Model that allows the user to quantify the cost associated with anticipated investor repurchase or putback requests under rep and warranty provisions. Additionally, the model allows the user to estimate the contingent liability requirements associated with future required repurchases.

Given the volatility the market has experienced recently, measuring price sensitivity given a variety of mortgage basis models is critical. Enhancements to WinOAS 4.1 SP3 allow users to create basis models based on a variety of techniques including mean reversion, volatility, and traditional discreet spreads. This flexibility is critical in ad-

dressing the sensitivity and stress testing requirements that the market is facing.

The previous release of WinOAS introduced MIAC's industry-leading Libor Market Model (LMM) term structure model. LMM has been enhanced in the newest WinOAS release to give an even more accurate match between model volatility and market volatility. This was done by an enhanced zero-error calibration of the market volatility surface. As a result, interest rate products with embedded optionality are priced with the highest degree of accuracy.

Considering the impact of home price depreciation on asset valuation and the financial markets in general, understanding the current, underlying property value associated with a mortgage-related asset is critical in accurately modeling project defaults and other borrower behavior patterns. DataRaptor 4.2 contains an automated interface to publically available FHFA home price index data at the CBSA level. This index is applied at the loan/property level in order to provide an updated, estimated property value which gives users the opportunity to accurately assess the risk inherent in their mortgage book.

Within DataRaptor 4.2, MIAC integrated with Standard & Poor's Levels® RMBS Credit Model, giving our whole loan valuation clients an additional option in modeling two of the critical components of loss - foreclosure frequency (or probability of default) and loss severity - at all S&P credit levels. S&P Levels output works seamlessly with the new Rating Default Model (RDM) within WinOAS. The RDM allows the user to specify a foreclosure timing curve over which to apply a loan/tranche-level probability of default.

## Integration Options

Over the past several years, as the financial markets have weathered a storm of write-downs, bailouts, and government takeovers, financial models have come under intense scrutiny, particularly those used to predict borrower behavior and key economic factors relevant for asset valuation. MIAC has always made available a variety of model options within WinOAS, particularly for modeling both defaults and prepayments. As we migrated to WinOAS 4.1 SP3, we updated our existing integrations with key third-party prepayment models. In addition, we have integrated with new credit models, giving our

clients flexibility in modeling a variety of potential outcomes or scenarios for their financial assets.

Specifically, WinOAS 4.1 SP3 is integrated with the following models:

- ▶ **Andrew Davidson & Co. Prepayment Model v5.2(g)**
- ▶ **LPS Applied Analytics (formerly AFT) Prepayment and Credit Model v546**

In keeping with MIAC's Open Box Technology concept, we also continue to work with our clients to integrate with their internal prepayment, credit, and rate models, updating those integrations with success model releases (both MIAC's and our clients). WinOAS provides the cash flow engine in support of these internally developed, client specific behavioral models.

## Verification and Validation

As noted in Alex Samuel's article "*Making Sure You Have the Right Model – And That Your Model is Right*", which also appears in this issue of *MIAC Perspectives*, verifying and validating any financial model is critical to successful system implementation and results. As we migrated each of our products to the newest version, MIAC applied an exhaustive testing and validation process, drawing upon resources in Development, Quality Assurance, Line of Business, and Product Management.

MIAC employs the entire suite of MIAC software products extensively in support of our consulting, hedging, pipeline management, and other third-party valuation assignments. As such, we have extensive experience in verifying and validating not only our own models, but in assisting our clients and their auditors in doing the same. Further, our modeling experience has given us an edge in validating third-party models as well, including reconciling our models to a myriad of client and other commercially available models.

Building again upon the principle of transparency, MIAC created a detailed reconciliation tool for WinOAS 4.1 SP3. This Excel-based tool allows users to reconcile each individual revenue and expense component inherent in the calculation of asset value. The tool incorporates open, user-verifiable

formulas providing a comparison of system-generated and user-generated calculation results at the component level. MIAC makes this tool available to our software clients as an integral part of our upgrade process.

## Transparency and Control

**M**IAC has always been in the forefront of providing our clients transparent, validated, sound financial modeling and data management tools. The most important principles that guide our upgrade efforts have always been Transparency and Control. While Sarbanes-Oxley brought these principles to the forefront almost 10 years ago, the most recent financial crisis only served to strengthen the need for models that are transparent and controllable.

MIAC put those principles to action in several areas. While WinOAS, MIAC's cash flow engine, has long incorporated functional permissions at the user level, we now have incorporated this same concept into DataRaptor 4.2, MIAC's robust data management tool. Clients have the ability to control, at the user level, the functions that can be performed within the system including building data templates, identifying and mapping key data fields, creating audit rules and business logic, and formatting and generating output.

These data functions, independently and collectively, provide the foundation for meaningful cash flow analysis and asset valuation. DataRaptor now provides the ability to track changes made within the system at the user level, giving clients the ability to hold users accountable for their work.

In WinOAS 4.1 SP3, MIAC has expanded the cash flow parameters that can be exported from the model. With transparency as our guide, we identified key elements impacting all asset valuations and explicitly incorporated those elements into the cash flow export function. These parameters, including P&I advance balances, escrow balances, delinquent payments (as opposed to delinquent loans), etc., are used to drive key revenue and/or expense calculations in the model.

As we added additional modeling capability into WinOAS 4.1 SP3 for cash flow streams such as escrow and corporate advances, we made sure that at the onset, all cash flow components to these calculations were explicitly available in the cash flow export tool. On the whole loan val-

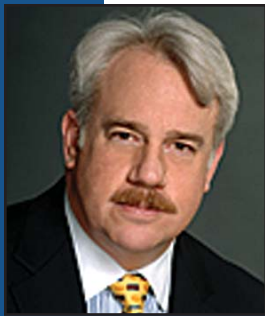
uation side, key cumulative cash flow parameters such as cumulative principal loss and cumulative liquidated balance, previously only available by exporting cash flows, is now available (at the loan/tranche level) as a standard output from the calculation process.

Also in WinOAS 4.1 SP3, the standard report set available to clients was vastly expanded, providing more transparency to both the valuation assumptions and the valuation results. The standard assumption reporting set was significantly expanded to include detailed information on model types, settings, and parameters. Users now have a clear and concise way of validating not only the assignment of models to groups of loans but also the specific details of the model implementation.

Finally, Windows Authentication was implemented across all MIAC Analytics software applications. Windows Authentication gives companies a single point of control for access to all systems, including MIAC Analytics products. User groups and permissions can be maintained in a central location without the need to replicate these groups and permissions within the MIAC applications. Access to the MIAC applications can now be driven from the Active Directory, making it simpler to manage and control without the need for individual, user-based permissions files.

## The Extras

**A**s with any software release, it's often the "little things" that make the most difference to the day-to-day users of our software, and this most recent release features a number of those "little things". From performance enhancements (like distributed processing capability in DataRaptor and enhanced portfolio loading speed in WinOAS) to user tools (like importing rules and tracing field dependencies in DataRaptor), speed, efficiency, and user experience once again played a key roll in MIAC's enhancement process. The highlights associated with MIAC's most recent release for both DataRaptor and WinOAS are many. From enhanced default modeling, to third-party integrations, to market-leading analytics, the MIAC Analytics suite of products provides our users with a solid foundation for analyzing and valuing a variety of assets even in today's unprecedented financial market.

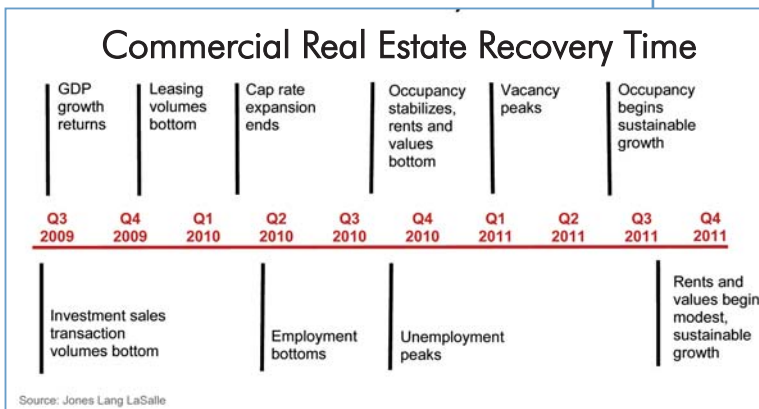


By Dean Hurley, SVP  
Capital Markets

## In Spite of Recovery Talk, We Aren't Done With the Problems

**W**hile many commentators are saying that the commercial real estate markets will recover in 2011, according to the Korpacz survey, “Rental rates will continue to decline until strong, consistent job growth resumes. With \$1.4 trillion of commercial real estate debt maturing by the end of 2012, some property owners will not be able to survive the downturn. Problems related to refinancing that debt could further delay a recovery in the sector.”

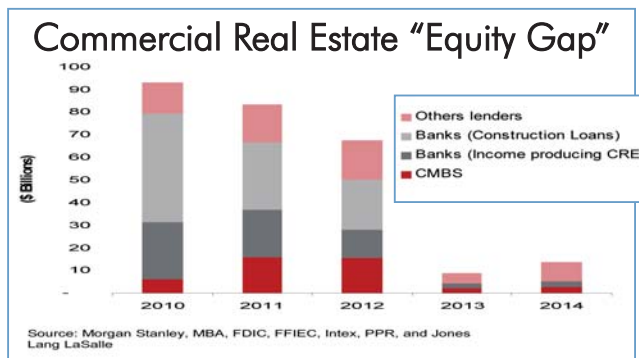
The chart below shows the prognosis according to major CRE property entity Jones Lang LaSalle.



MIAC believes that this forecast is more realistic than those anticipating a CRE recovery to begin earlier in 2011. MIAC sees a drawn out recovery where many segments of the market take much longer to show signs of improvement. Hotel and retail in good locations should improve with employment, while office and industrial should lag in the usual pattern. This is partly because of the nature of CRE and partly because of the nature of this recovery. The depth of this recession coupled with current regulatory and taxation

uncertainties bode ill for a faster recovery timeline in our opinion.

The chart below from Jones Lang LaSalle shows the difference between debt outstanding at maturity and the level of debt sustainable based on normalized LTVs of about 68%. This highlights the fact that large amounts of maturing loans will not qualify for refinancing. Recent statistics have shown a drop in the percentage of loans successfully refinancing at maturity to 20.5% by balance last month according to Cushman and Wakefield. The lowest figure we recall was 18.7% in November, 2009. Three to six months after maturity, the refinanced or paid off percentages climb to 33% and 56% respectively.

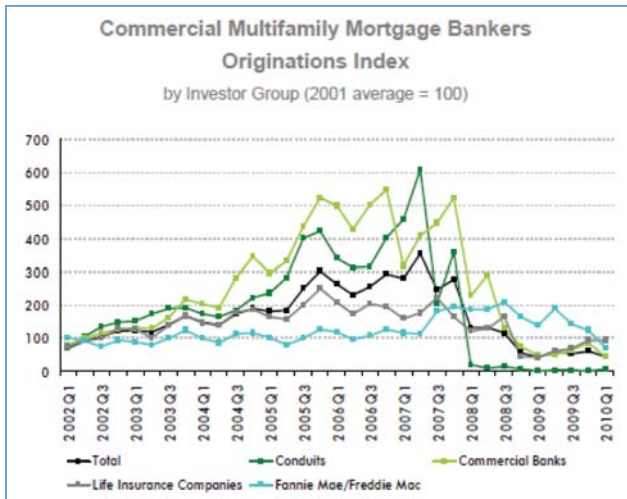


## CRE Lending

**I**n spite of repeated announcements that conduit vehicles are returning to the CRE lending markets, we feel that there is little activity to be looked for there. The truth is that the very best deals are being financed by the life insurance companies, while small borrowers with established bank contacts are holding on to these funds sources for dear life. There currently isn't enough funding from these lenders to meet expected demand. An article written by Brian Halpern of CBRE Capital Markets, “Debt – The Haves or Have-Nots” states it quite clearly below:

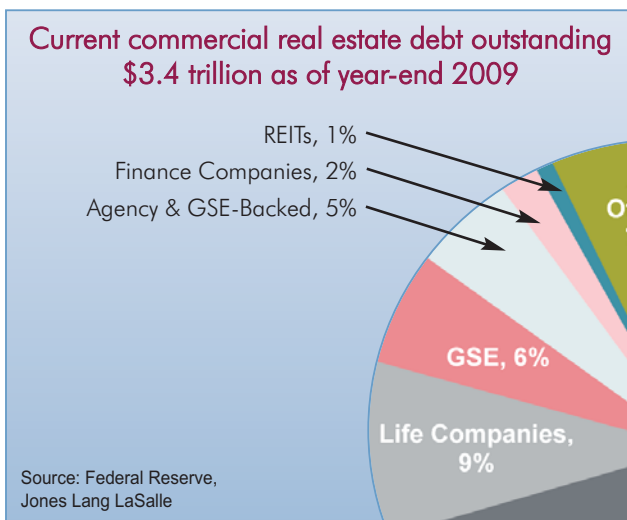
*“Asset and sponsorship strength along with market concerns continues to trump the renewed lender demand to place mortgages. At this stage in the recovery, you either have what the lenders want or you'll have to keep on looking . . . The 'haves' of available debt consist of those seeking acquisition finance for institutional quality assets with limited lease-up or rollover exposure. Deals fitting into that box can expect up to*

70% leverage . . . The 'have-nots' consist of properties suffering from vacancy challenges, above market rents, and rollover exposure, among other problems. To date, the life companies have been unwilling to work outside their comfort box to meet their industry's increased demand to place capital."



So, who is holding the CRE debt, and who is extending the new debt? According to FRB, the graph below reflects distribution of \$3.4 trillion of CRE debt.

We see a "funding gap" over the next two and a half years. Recent studies have suggested that traditional sources of CRE finance only offer about \$200 billion of funds annually for CRE lending (based upon a recent three year average of loan originations by this group). However, just to refinance CRE maturing



debt a total of \$500 billion will be needed over the rest of 2010, 2011 & 2012. This "funding gap" doesn't take into account funding for

defaulted CRE loans (by way of financing purchases of notes and REO from lenders and servicers).

## Who will fill this gap?

The touted "CMBS 2.0" will not fill this funding gap any time soon. True, banks and life companies are forming CMBS 2.0 programs. However, at the CMSA January conference, in an informal poll of investors cited by Keith Mullen of the Winstead law firm, 58% of the investors believed that "CMBS 1.0" style multi-borrower, fixed rate pools will return no sooner than 2012 (or even later); and 69% of the investors believed that new, annual CMBS issuances would not exceed \$100 billion until 2013. This partially explains why the new "CMBS 2.0" programs will be underwriting loans as if they were going to hold them on their books – and not sell them in a securitization. While, more recently, the just completed (June 11th) sale of the bonds on the J.P. Morgan Chase Commercial Mortgage Securities Trust 2010-C1 CMBS transaction is a very positive sign, and we note the re-constitution of CMBS asset groups at Wells and several other financial institutions per June 17 Reuters article, we continue to believe that it will be a long time before we see CMBS anywhere near what it once was.

Bank CRE lending will not fill the gap. Bank credit allocations for CRE will probably decrease for the near term (up to five years), for several reasons.

▶ Recently, the US Controller of the Currency spoke at the annual convention of the Independent Community Bankers of America, and called on policymakers to devote special attention to the CRE lending concentrations at banks.

He then suggested a lengthy list of options, all of which would reduce lending risks AND result in less capital available for CRE lending. Other regulators and legislators are similarly pushing to require banks to hold increased levels of capital. The Congressional Oversight Panel report from February and Sheila Bair of the FDIC cite similar concerns. Regional and community banks

have high CRE loan concentrations. MIAC looks at bank asset portfolios regularly, and commercial loans of various types (CRE, ADC, C&I and Land) approximate the majority of the balance sheet assets at many small and mid-sized institutions.

► The Financial Accounting Standards Board is proposing that banks expand their use of market values (called “mark-to-market”) for financial assets such as loans. If these accounting rules are implemented, then this will be another pressure on banks to make less capital available for all but the most secure deployment of funds, and to reduce price volatility by shortening portfolio durations. This bodes ill for CRE lending.

Insurance company CRE lending will not fill the gap. Recently, the Capital Adequacy Working Group of the National Association of Insurance Commissioners (“NAIC”) voted to release for comment a proposal that might result in a large increase to the risk-based capital (“RBC”) charges for life company holdings of CRE mortgages. If passed, this could significantly restrict the ability of some life companies to make capital available for CRE lending.

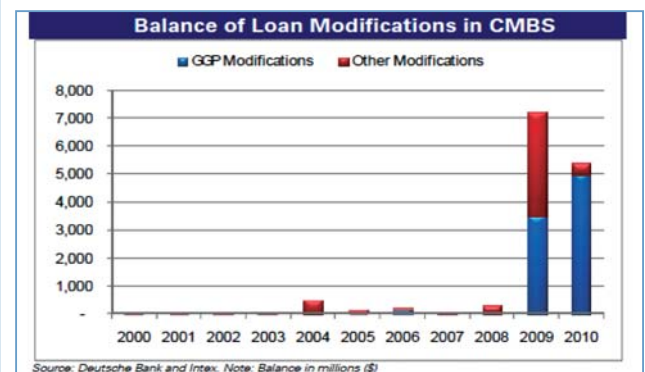
While this situation presents opportunities for non-traditional lenders such as mortgage REITs, the situation on the ground according to the market buzz is that CRE deals qualifying for this type of financing are few and far between today. These lenders are usually looking for institutional grade assets and sponsors, and want to underwrite closer to life company standards than non-life lenders have historically done. With CRE performance still “in the tank” (the traditional lag in the recovery of CRE assets after a recession) and because CMBS asset resolutions are being attenuated by extensions, MIAC believes it will be several years before enough assets emerge to qualify for these kinds of lending programs.

## Extend and Pretend

It has been said here before. We see extensive extending happening. Recent changes in US Treasury regulations have made it easier for CMBS servicers to “modify” these loans, and they are beginning to pick up the pace. We also continue to believe that attenuating the problem will prove ultimately better than the alternatives, particularly where any fresh equity can be obtained. Lags in the performance of CRE notwithstanding, an economic recovery offers the possibility (or hope) that property owners can soften or improve

declining cash flow situations sooner rather than later.

We agree with Real Capital Analytics, Inc.’s statement that government and regulatory policy will have greater impact on pricing than occupancy levels or rents. “Policymakers control what happens to commercial mortgages in default,” Robert White, the president of Real Capital Analytics, wrote a few months back. They “have encouraged loan modifications and extensions even in cases where loans are above a property’s current value. Tax policy, meanwhile, has made it easier for special servicers to negotiate with borrowers, a move meant to prevent a wave of maturity defaults and property fire sales. Keep rates low and easing restrictions on foreign capital will also influence industry prospects.” Real Capital Analytics notes that commercial mortgage-backed securities (CMBS) hold 42 percent of distressed loans; American banks 31 percent; and



foreign banks 13 percent.

Deutsche Bank did an extended analysis in April of the new reality of CMBS loan modifications in their report “CMBS Research, Loan Modifications in CMBS Step into the Spotlight”. According to Deutsche, between 2000 and 2008, a total of \$1.1 billion of CMBS loans had been modified and in the last 15 months another \$12.6 billion of loans have been modified.

## Conclusion

MIAC is continually monitoring the factors that influence market values for seasoned loan assets. We consider the demand for and supply of new loan product to be a particularly important set of variables to monitor. The collapse and very slow re-emergence of CRE lending in the capital markets space, and regulatory factors impacting banks’ abilities to make such loans in the future, is a critical area for all interested parties to follow closely. MIAC has the expertise to help today’s banks understand the markets and their impact on the value of bank assets.



By Alexander Samuel, VP  
Capital Markets

## Making Sure You Have the Right Model And That Your Model is Right

### A World of Models

**T**he world is inundated with models in every realm of life. In the physical sciences, models operate within a controlled environment where an experiment can be repeated over and over again. Models can be built to simulate an experiment and can be perfected to significant precision. However, building models in the social sciences to simulate an experiment presents additional challenges. Given the same scenario over and over again, human beings will not necessarily act in the same manner. As a result, modeling that involves elements of human behavior (such as prepayment and default) is quite difficult, and testing these models is even more difficult. Despite these challenges, modeling and model testing have a prominent place in real world applications from measuring risk to asset valuation to financial forecasting.

The mortgage world is commingled with many elements of human behavior which makes mortgage analytics very challenging but also highly useful. Not just the mortgage world but the whole financial system is driven by models. Models are used everywhere from forecasting defaults to estimating counterparty risk, valuing complex derivatives, and analyzing a variety of risks. They are critical in the decision-making and risk assumption processes inherent in our financial system. Models that are not appropriately tested can bring the entire financial system down. As they say, an untested model is nothing more than a mere conjecture. Although models pertaining to social science have many obvious challenges that arise because human behavior is involved,

model testing plays a vital role in the ensuring the usefulness of these models in the financial world.

### Risk Evaluation Needs Useful Models

**M**odel testing should help the management of financial enterprises avoid making very risky decisions that have the potential to put a company's survival in jeopardy. Model testing should help the company by revealing whether the model is right (and the right model is being used) to measure risk appropriately.

Since 2008, more than 200 banks have failed. Additionally, many other banks and financial services firms received funding from the government during the same period in order to avoid a similar fate. In addition, the Federal Reserve and other bank regulators embarked on a comprehensive assessment of the capital held by the 19 largest U.S banks and ordered 10 of them to raise a total of \$75 billion in extra capital (Treasury's Supervisory Capital Assessment Program, or "SCAP", completed in the spring of 2009).

What is the reason for these failures? Is it because these institutions failed to appropriately measure the risk of their highly levered investments? Is it because they relied on unregulated investments wrought with enormous risk to drive growth? Is it because some large banks used leverage of 20 to 1 or 30 to 1 to invest in subprime loans that were packaged into mortgage-backed securities? Or is it because they were speculating? Even if they were speculating, wouldn't it still be prudent to measure the risk exposure under a stressed scenario? Why did these large banks and financial firms fail to stress test their liquidity risk model? Failure to understand the stressed scenario, in a highly leveraged world, results in significant exposure, and depending on the magnitude of the risks taken, it can affect not only a firm's balance sheet but, as we've seen, the stability of financial markets as a whole. Hopefully, after enduring this long and painful credit crisis, the financial world has a new appreciation for the importance of stress testing as a prudent risk management practice.

These disasters may have been avoided or partially avoided had there been an adequate level of stress testing enabling a better understanding of the risk exposure in a stressed scenario. But to have good stress testing, valid models must exist to perform the stress testing correctly. On the other hand, some may argue that models are not robust enough to yield reliable results under stressed scenarios. As the

OCC said in their Validation of Credit Risk Rating Models Conference in February 2006, “All models are wrong but some models can be useful.” Said differently, all model outputs have error, yet the best models are those that minimize this error.

## The Purpose of Model Testing

**M**odel testing, then, is designed to make the errors as small as possible, thereby making the model more useful and reliable. What does model testing entail? Model testing consists of two components:

1. **Model Verification:** A process to ensure that the model is right
2. **Model Validation:** A process to ensure that it is the right model

Although model verification and model validation are both part of the model development process, the second component, “model validation”, is an ongoing, interactive process. Model validation is a process to make sure that the model does not become stale over time, because the right model today may not be the right model tomorrow. Effective models continue to evolve in the market place as regulations change or as the market itself evolves. MIAC views the model verification and validation process as the key to continued innovation in all of its tools. It is the first and foremost way of ensuring that MIAC continues to offer the right models to our clients. As such, MIAC looks both internally and externally at the results of the model validation process around each of its tools as a way of establishing development priorities and delivering the right models to its clients and to the broader market.

## What is Model Verification?

**M**odel verification is a process to ensure that the model is right. In other words, model verification ensures that the model correctly simulates the process it is intended to simulate under a variety of scenarios, both typical and atypical. This is accomplished through verifying the following:

1. Is the model mis-specified?
2. Is the model programmed correctly?
3. Is the model implemented correctly?

Model verification is not a perfect science and there is no such thing as a model that is completely verified, especially one that involves human behavior. However, as more and more cases are tested, the degree of certainty improves. In other words, through repeating the model verification process, model errors are discovered and corrected, and we thereby improve the reliability of the model. This evolutionary process results in making the model as accurate as possible.

## What is Model Validation?

**M**odel validation is a process to ensure that the right model is used. In other words, it demonstrates that the chosen model reasonably represents the actual real world process. This is done through testing three main components and reviewing five ancillary components. The testing of the main components is done to reduce the model risk; and the reviewing of the ancillary components is done to reduce operational risk. The three main components to be tested are:

1. **Model Data and Assumptions:** To ensure that the data is logical and accurate and that the assumptions used are sound. The soundness of the assumptions can be gauged through back-testing, benchmarking and/or through the use of various statistical measures.
2. **Model Parameters:** To monitor the sensitivity and the volatility of the parameters and update the parameters as additional empirical data becomes available.
3. **Model Output:** To ensure the results are reasonable and reliable through back-testing, benchmarking and/or through the use of various statistical measures. In addition, stress testing, sensitivity analysis and scenario analysis must be performed to understand the complete spectrum of the risk exposure.

The ancillary components to be reviewed include:

1. **Model Governance:** Model Governance should be well balanced. A very extensive program can be as bad as (or could be worse than) a program that barely meets some minimum requirement of functionality. Among other things, model governance should provide guidance on:

- What is a reasonable definition of a model that requires validation?
- How to measure the model risk?
- How often to perform model re-validation?
- What is the minimum level of independence required of the validator?
- At what point can a model go into production?
- What is the retention policy for inputs, reports, and documentation?

**2. Model Documentation:** This should contain:

- A technical manual that describes the underlying mathematical theory behind the model, including its strengths and weakness
- A user manual that describes how the model is used by the end user

**3. Model Inventory:** This is a catalog of all models used enterprise-wide, providing, among other things, the following information:

- The purpose of the model
- The date the model was created and name of the model developer
- Line of business responsible
- Model risk defined by the criticality and complexity of the model
- Status of model validation and summary of any major issues

**4. Model Change Control:** This should provide guidance on:

- Frequency of model changes
- Model change approval process
- Requirements that trigger model re-validation
- Parallel-run requirement before the new model is put into production

**5. Model Security:** This should provide guidance on:

- Who should have access to the model and the model code?

- Where and how often should a model be backed-up?
- How secure should the model and the model location be?

By performing testing of the three main components and by reviewing the five ancillary components, the evaluator discovers if the right model is being used. It is important to remember that model validation is not a onetime process.

## Industry practices on model testing

A vast majority of financial industry participants use the word “validation” to mean both validation and verification. Very rarely does anyone in the industry make the distinction between the two processes. There are three main model validation articles published by US regulators that are widely cited by all financial institutions:

- OCC 2000-16 Bulletin
- FHFA Advisory Bulletin 2009-AB-03
- Model Governance published by FDIC in its Supervisory Insights (Winter 2005)

Although the definitions of model validation as given by these three governing articles are slightly different, they are all consistent with the above description of model verification and model validation.

- *OCC 2000-16* defines validation as a process that not only increases the reliability of the model but also promotes improvements and a clearer understanding of a model’s strengths and weaknesses among management and user groups
- *FHFA Advisory Bulletin 2009-AB-03* defines validation as a process of determining that a model’s results accurately reflect the intended use of the model
- *FDIC Supervisory Insights* defines validation as an activity that assesses how effectively a model is operating

Despite the wording differences among these three definitions, all three articles governing model validation prescribe the same list of activities to be performed during model validation. Following is

the list of activities prescribed by all three model validation governing articles:

- Independent review of model's logical and conceptual soundness
- Review inputs
- Review output
- Review model code
- Replicate model
- Sufficient model documentation to facilitate validation, replication and training
- Prescribe frequency of re-validation

Given all this literature on model validation, it would be an interesting exercise to see how the industry participants perform model validation. Is there a gold standard in model validation? Or is the standard still evolving? The Risk Management Association (RMA) conducted a best practices survey on model validation across 45 large, global financial institutions in 2009, and the results of the survey were published in the 2009 RMA Journal. It states that 82% of the participants have an independent model validation unit within their institution. 84% have a model validation policy. About 75% validate a model or model change before putting the model into production. 100% of the survey participants review each model's logical and conceptual soundness, however significantly less perform all of the other aspects of model validation including reviewing model documentation (75%) and performing scenario or stress testing (34%), and so on.

## MIAC Practices on Model Verification and Validation

Maintaining the longstanding and widespread market acceptance of MIAC's proprietary software is the first priority of MIAC's model verification and model validation process. Implicitly this means that MIAC tools have been (and will continue to be) independently verified and validated by a variety of market participants. In addition, MIAC continues to perform every aspect of model verification and validation internally; and, on many occasions, MIAC tools have been subjected to rigorous testing by various third-party mortgage modeling experts.

What are some of the ways MIAC verifies and validates its proprietary software? First, we begin with verifying and validating each specific enhancement or change request. Additionally, we perform re-

gression testing to ensure that changes made to the model do not inadvertently "break" other parts of the model and that the changes made hold true in an exhaustive set of scenarios, both typical and atypical. Specifically:

1. Developer tests coding changes and builds beta version of the software
2. Automated scripts are run, looking for discrepancies in results against the prior version, or "regression" testing
3. Quality Assurance tests the changes against the specifications provided
4. A Business Analysts also tests the changes with a broader view of scenarios
5. Updated programs are run by a select team for a period of time for further validation
6. Testing results are verified by a model validator
7. Verified and validated programs are put into production

MIAC makes a variety of tools available to its clients for model verification and validation, which allows clients to replicate substantially all of the calculations inherent in its cash flow model. Further, we offer change tracking and permission tools which give clients confidence in their ability to control their processing environment, helping to ensure quality output. In addition, an independent Statement on Auditing Standards No. 70 (SAS70) audit is performed routinely at MIAC to evaluate the suitability of the process controls in place and to certify that those controls were operating effectively during the audit period.

Model enhancements and model changes are tracked and monitored in a software project tracking tool, and routine meetings are held between the business and development teams at MIAC to review, assess, and prioritize all model changes. At MIAC, every model enhancement and model changes go through the rigor of model verification and validation process. MIAC not only takes pride in its rigorous model verification and validation process but also on its ability to quickly respond to enhancement requests (from internal and/or external sources) that arise from the validation process.

Verification of third party vendor models is usually difficult as these models tend to be proprietary in nature. Vendors, in most cases, provide minimal information to their clients making their model a true black-box. Difficultly in doing model verification does not liberate the end user from performing

model verification. Even in a black-box situation, model verification is still a necessary evil, even when assistance and tools from the vendor to assist in the process are minimal. MIAC's goal is to provide our clients all of the tools necessary, including access to business professionals, developers, and verification tools, to verify and validate all MIAC proprietary software and configurations.

MIAC strongly believes in getting the model right and getting the right model to its clients. In the recent years, MIAC has increased its investment in model verification and validation to meet the following three objectives:

1. Ensure with high certainty that MIAC's proprietary models are right and that they are the right models for valuing any financial product;
2. Assist MIAC's clients in validating all MIAC proprietary software and its configuration; and
3. Provide third party, independent financial model verification and validation for any financial institution needing this assistance.

MIAC proprietary software continues to evolve in accordance with the current needs of the market and the changing regulatory environment. The mortgage world is changing at an extremely fast pace, and MIAC understands the importance of being

a leader in adapting to the evolving needs of the mortgage market and its clients.

## Conclusion

**A**lthough model verification and validation is a must for a prudent risk practice, it is not a be-all end-all risk management exercise. The real world is very fast paced, and there is no substitute for human judgment and intelligence. A trader might not be able to wait until all the model validation and verification is done before a trade can be executed. When new information becomes available in the market, the trader often must use innate intelligence and experience to immediately execute a decision based on best judgment.

In the truest sense, a fully verified or validated model does not exist in the financial realm. When a model is verified and validated, it means that particular model has gone through a battery of tests to increase the usefulness and reliability of the model. Model verification and validation enhances the understanding of the model's capabilities, limitations, and proper usage. But the cycle of validation and verification never ends, particularly in our increasingly complex and dynamic financial market.

So what is most important? No matter how perfect the model is, if it is not the right model, it is of no use. It is necessary to have a model that is right, but that



by Dan Thomas,  
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## Commercial Servicing: Market Update

### Overview

**T**he growing problems within the commercial real estate market are front and center after playing second fiddle to the residential market for all of 2008 & 2009. Monthly CMBS delinquency rates have steadily increased from 1.66% in March 2009 to 6.4% in March 2010, with delinquency projections of close to 11% by De-

ember 2010! During that same period, loans moving to special servicing also have increased dramatically from roughly \$20 billion in March 2009 to \$80 billion in March 2010. This market disruption has resulted in changing dynamics within the commercial servicing sector. Servicers are losing servicing income through involuntary prepayments (defaults). Additionally, the low interest rate environment has reduced the interest income component of commercial servicing. Lower originations, particularly in the CMBS sector, have impaired servicers' ability to replace lost loans with new servicing. The effect of all these factors has been to increase the demand for all types of commercial servicing.

### Supply / Recent Transactions

**T**ransaction volume in the commercial servicing market in Q4 2009 and Q1 2010 was still extremely light in relative terms, mostly due to the lack of new CMBS issuance. One bright spot

for the market was the issuance of seven Freddie Mac Capital Market Executions, which had a combined unpaid principal balance of approximately \$6.2 billion. The auction of both the master and primary servicing for those securitizations was very strong with bids significantly higher than anticipated.

There have been several notable Commercial Servicing transactions that have occurred over the last two quarters that are part of company sales. Centerline Capital was purchased in part by C-III Capital Partners, LLC, which is an investment vehicle of Island Capital. Centerline is an Agency and Special Servicer with a portfolio of approximately \$9 billion. In another large transaction, an investment group led by Dallas, Texas based ORIX USA Corporation and including Stonehenge Partners of Columbus, Ohio, acquired Red Capital Group from PNC Bank, N.A. The approximate size of the commercial MSR portfolio in that transaction was \$11 billion of predominately Agency servicing as reported by the Mortgage Bankers Association. Another notable company transaction as reported in Commercial Mortgage Alert publications in April & May 2010 editions, was that CW Financial Services and its servicing unit CWCcapital are in the final round of auction. CWCcapital is both a Primary and Special Servicer with a portfolio of approximately \$11 billion of primary servicing and \$160 billion of Special, \$11 billion of which is currently actively managed. Interested parties as reported by the publication have been several new entrants into the commercial servicing field including; Fortress, Ladder Capital, Starwood Capital, Vornado Realty and Apollo Capital. These nontraditional investors in the commercial servicing market have been especially interested in the Special Servicing unit of CW Capital and others such as LNR Property Corp. Special servicers have strong access to borrowers and investors and potentially an inside track on the disposition of the collateral backing defaulted CMBS bonds. Those operational and relationship dynamics

have made Special Servicers extremely attractive to real estate investors looking for opportunity in this distressed commercial real estate market.

## Market Values

Market values continue to remain strong from prior periods. This strength has been mostly driven by demand and the lack of supply available to market participants. Additionally, MIAC has seen several of the top buyers increasingly use more aggressive pricing assumptions in their bids. The five major factors influencing commercial servicing values ranked by importance to cash flows are prepayments, the cost to service, the earning rates on escrow, P&I and reserve balances, discount rates, and ancillary income. Listed below is an approximate range for each assumption based upon discussions with market participants and the recalibration of recent market trades for Agency and CMBS primary servicing.

As expected, the large servicers that are owned by depository institutions continued to be at the more aggressive end of the range for every assumption category. MIAC does not see any factors in the marketplace in the foreseeable future that would change that dynamic.

## Outlook for 2010 & Beyond

Servicing prices should remain stable for all types of commercial servicing for the remainder of 2010. MIAC believes that market demand will remain strong for the majority of the asset classes in this sector provided that earnings rates do not drop to zero and stay there for an extended period! As noted above, delinquencies and default rates are rising dramatically and they will continue to have a significant impact on the commercial servicing market due to the loss of servicing revenue. MIAC has conducted a default price sensitivity analysis on a large sampling of approximately \$300 billion of mixed Agency and CMBS

primary commercial servicing rights. Based upon that analysis, we estimate that the overall value of the portfolio would drop 4.2% - 6.4% if defaults doubled over the next year and remained at that level for 18-24 months. Individual portfolio attributes would yield higher or lower results, but the model dynamics are pretty clear: higher defaults yield lower values.

ASSUMPTION	LARGE SERVICER	MID-LEVEL SERVICER
Prepayment Rates	0 - 3.50 %	0 - 3.50 %
Cost to Service	\$1,000 - \$2,000	\$4,000 - \$6,000
Earnings Rates	2.50% - 4.00%	0.50% - 4.00%
Discount Rates	7% - 12%	10% - 15%



By Mike Carnes , SVP  
Capital Markets

## MSR Market

### Residential Market Update

**T**he back and forth nature of the news driving today’s market can be confusing to say the least. Because of the multitude of mixed messages, some have even begun to describe market conditions as being “Bipolar”. To help put recent market challenges into perspective, we must focus on the fundamental drivers of value. In this case: delinquencies, prepay speeds, and market volatility.

### Delinquencies

**A**ccording to the Mortgage Bankers Association (MBA), delinquency rates hit an all time record, surpassing the 10% level in the first quarter of 2010. The seasonally adjusted rate is an increase of 6.2% over the previous quarter and 10.3% ahead of one year ago. Virtually all product types endured an increase in delinquencies over a 12-month span and prime mortgages, which make up 68% of the market, posted the largest increase with serious delinquencies up by a whopping 16%. However, the same MBA report showed the non-seasonally adjusted delinquency rate declined by 11.3% from the previous quarter. Is the drop simply capturing the normal decline, or is it reflecting a broader indicator of sustained market improvement?

Delinquencies in servicing portfolios of different firms can vary drastically depending on 1) loan type 2) degree of participation in various loan modification programs and 3) foreclosure moratoriums. Longer foreclosure timelines impact the timing of losses and therefore negatively impact loss severity due to higher interest advances and other carrying costs such as maintenance fees, property taxes, etc. The longer timelines are largely dependent upon servicer ca-

capacity as well as a firm’s ability to adapt to government guidelines such as HAMP.

While loan modifications can artificially lead to higher cure rates and lower near term defaults, re-default rates will vary drastically depending on the type and term of the modification. Principal and Interest recapitalization modifications impact the timing of losses, but will have no impact on the loss amount should the borrower re-default – not to mention that re-default rates under this approach can be higher than with other methods. On the opposite end of the spectrum, principal forgiveness will cause losses to come sooner, but the lower CLTV should result in lower defaults as well as reduce the need for future principal write-down.

The combined effect on re-default rates and the impact on cash flows can be complex, but one thing appears certain: borrowers are more likely to re-default when their monthly payments aren’t reduced enough in modifications to make staying in a home affordable. With roughly one-fourth of homeowners owing more on their home than their home is worth, the type of modification will be key in reducing future loss severity. Additionally, studies show that early intervention produces better results. Borrowers current on their payments now but at high risk of default are much less likely to re-default than borrowers who received modifications after missing one or more payments.

As more foreclosures are worked through the system, as more modifications are completed and as cleaner, newer vintage product starts to make up a larger percentage of a firm’s portfolio, it will eventually have a positive impact on a portfolio’s overall performance matrices. Until then, the market needs to have a good handle on how to address the increased risk exposure.

Despite the fact that foreclosure inventory rates are up by over 20% year-over-year, Mortgage Servicing Rights coupled with the current rate environment are showing tremendous resiliency in light



of adverse conditions. The below graph displays the historical results of MIAC's hypothetical auction process of a select group of Generic Servicing Assets in which numerous firms participate.

## Prepayment Speeds

Now, let's shift our focus to prepayment speeds. During this period of ongoing volatility, prepayment expectations show a wide variance from firm to firm and can produce a serious whipsaw effect on values without hands-on servicer intervention. The Bloomberg caption below shows how speeds can vary widely between firms.

Firm	PSA	Yr	Mo	WAC	-300	-200	-100	-50	+0	+50	+100	+200	+300
CS	723	27	8	5.65	1247	1213	1034	893	723	531	304	133	110
DB	542	29	3	5.59	2092	1986	1616	887	542	542	542	137	116
UBS	506	29	0	5.66	1599	1599	1261	842	506	320	235	113	103
SAL	786	29	9	5.75	2299	2299	2101	1471	786	437	196	134	112
RBS	665	29	5	5.39	1959	1837	1614	1186	665	355	234	163	126
MS	303	28	1	5.64	957	946	776	513	303	235	193	106	77
JPS	444	28	7	5.50	1560	1483	1241	803	444	241	157	109	93
BOA	561	29	0	5.66	1519	1466	1338	1028	561	280	189	142	123
GS	358	29	2	5.67	2071	2033	1686	1047	358	241	164	111	95
BAR	283	29	11	5.40	1923	1765	1007	491	283	204	157	113	98
BNP	256	29	3	5.54	1016	977	620	407	256	203	181	156	150
NOM	415	29	0	5.65	1576	1567	1158	815	415	278	189	134	112
JEF	339	29	5	5.45	989	813	639	465	339	202	145	112	102
Avg	475				1601	1537	1238	834	475	313	222	128	109
MED	444				1576	1567	1241	842	444	278	189	133	110

Furthermore, recent declines in secondary rates are being partially offset by a widening of the primary/secondary spreads. As illustrated in the table below, primary base mortgage rates are approximately 75 basis points higher than secondary current coupon mortgage rates. This compares to a historical average of approximately 50 basis points. In assessing an MSR value, it is critical that one incorporates the true refinancing rate as opposed to a secondary rate plus a constant spread; otherwise, one runs the risk of over inflating pre-pay speeds.



## Market Volatility

Shifting our focus from prepay speeds, weak market sentiment being fueled by market volatility and continued high unemployment is not very encouraging. High unemployment remains one of the biggest risks to sustained economic recovery. Until unemployment claims begin to show noticeable improvement, earning rates will likely remain fairly range bound. Many clients rely on longer-dated escrow earnings rates in the two-through-five year swap sector and as the below chart suggests, recent recovery attempts quickly turned negative again.

## Conclusion

Regardless of how conservatively or aggressively your firm chooses to value its MSRs, it's highly recommended that you know your data and ultimately what assumption matrices must be assigned to produce reliable MSR values. It is entirely possible that your values are either under or over valued and only a thorough understanding of your portfolio's collateral attributes coupled with today's market conditions will suffice in the determination of MSR worth.

Unfortunately, a firm may try to support a particular value by saying the Option Adjusted Spread (OAS) is rich to static, or there are no available benchmark trades occurring, or my cost to service is lower than the rest of the industry. At times, all of these arguments may have merit, but be cautious of the fact that trade activity is quietly heating up, thereby providing a much needed market benchmark. On the flip side, some companies tend to overestimate their risk exposure, thereby causing the firm to book at a level far below a fair market price. Neither approach is recommended, and both require careful oversight in order to avoid false values.

**Questions to ask yourself and the rest of your management team in managing your portfolio include the following:**

1. How does your firm's strategy for handling the increased risk exposure compare to your competitors'?
2. Do you have the MSR modeling capabilities to estimate risk?
3. How are you incorporating revised loan to values into your valuation process?
4. Are you incorporating other performance matrices like vintage year, FICO, and geographic distribution into your default projections?

- How are you using the collateral attributes to value the MSR's?
- Is specialized subservicing a viable alternative to your current servicing approach?

For those of you contemplating the purchase of servicing, consider the following. In spite of recent resiliency, MSR values remain at historically low levels, which creates one of the best buyer's markets in history. From MIAC's perspective, we believe prices for servicing have dropped to very attractive yields relative to the risk profile of the asset class. We believe the economics (forecasted cash flows) of MSR's are intrinsically worth more than current market values due to supply/demand dynamics and an overly risk-sensitive market. This holds true across

HELP for explanation. CurncyHP

CLOSE/VALUE Page 1 / 3  
 USSWAP5 USD SWAP SEMI 30/360 SYR PRICE 2.2950 Composite(NY)

Range 11/24/09 to 5/24/10 Period Daily HI 2.9837 ON 1/ 1/10  
 Market mid/trd AVE 2.6621  
 LOW 2.2855 ON 5/20/10

DATE	PRICE	DATE	PRICE	DATE	PRICE
F 5/7	2.4490	F 4/16	2.6310	F 4/16	2.6310
T 5/6	2.4590	T 4/15	2.7060	T 4/15	2.7060
W 5/5	2.5360	W 4/14	2.7400	W 4/14	2.7400
T 5/4	2.6120	T 4/13	2.7045	T 4/13	2.7045
M 5/24	2.2950	M 5/3	2.6670	M 4/12	2.7230
F 5/21	2.3050	F 4/30	2.6090	F 4/9	2.7735
T 5/20	2.2855	T 4/29	2.6520	T 4/8	2.7890
W 5/19	2.4050	W 4/28	2.6900	W 4/7	2.7470
T 5/18	2.3745	T 4/27	2.6370	T 4/6	2.8520
M 5/17	2.4735	M 4/26	2.7510	M 4/5	2.9350
F 5/14	2.4403	F 4/23	2.7540	F 4/2	2.8635
T 5/13	2.5100	T 4/22	2.7005	T 4/1	2.7790
W 5/12	2.5370	W 4/21	2.6460	W 3/31	2.7330
T 5/11	2.5120	T 4/20	2.7030	T 3/30	2.7345
M 5/10	2.5130	M 4/19	2.6830	M 3/29	2.7290

all sectors including Agency and pockets within the higher touch sector such as Non Agency and certain Ginnie Mae collateral pools.



By Edmund Li, VP  
Financial Engineering

## MIAC's Constant Maturity Mortgage Calculator

In the past decade, CMM products (constant maturity mortgage forward and constant maturity mortgage swap) have emerged in the mortgage market as very effective hedging instruments, especially in the servicing hedging area. The mortgage market has two distinguishing characteristics: (a) first, the mortgage products have negative convexity; (b) secondly, the valuation of mortgage products (WL, MSR, and TBA) is all dependent on certain prepayment models. This results in pricing values of mortgage assets from different firms often being difficult to compare. The purpose of the CMM rate (index) is to build a term structure of mortgage rate that is a *market universal mortgage rate structure independent* of prepayment models and without negative convexity. Furthermore, this rate structure can be compared not only across different firms but with other (Treasury, LIBOR/Swap) markets as well. An example of a CMM forward rate structure usually appears as follows:

	OBS DATE	CMM FORWARD	SPREAD TO SPOT
SPOT	05/22/09	4.203	0.0
1M	06/22/09	4.213	1.0
2M	07/22/09	4.233	3.0
3M	08/24/09	4.243	4.0

The emergence of CMM derivatives has changed the traditional way servicers hedge the mortgage rate risk. In this short essay, we briefly go through the CMM index calculation (both spot and forward) and discuss some application of CMM products in the mortgage markets.

### 1. Spot CMM rate calculation

The spot CMM rate calculation has been standardized in the mortgage community. It is the direct result of the 30-day forward current coupon, straddled by the discount and premium coupon of two TBA prices, that produces the par TBA price. The standardization of CMM rates has universalized the current coupon calculation in the mortgage community and is now a benchmark

$$CMM_{spot} = ((P_{pre} - 100) / (P_{pre} - P_{disc})) * Cpn_{disc} + ((100 - P_{pre}) / (P_{pre} - P_{disc})) * Cpn_{pre}$$

where the price  $P_{pre}$  and  $P_{disc}$  have been adjusted for cash flow delay. The spot CMM rate from the above formula will be translated in a BEY format. The spot CMM rate lays the foundation for the forward CMM rate calculation.

## 2. Forward CMM rate calculation

The forward CMM rate is a little complicated compared with the spot CMM rate. There are two consecutive steps for constructing forward breakeven CMM rates. First, since TBA is negative convexity, the TBA price has to incorporate the adjustment of this convexity. The adjustment takes the form:

$$P_{0CMM} = P_{TBA} + (1/2)(C_{conv}) * \sigma^2 t$$

where  $P_{0CMM}$  is the rate after the convexity adjustment. In the above expression, the ideal candidate of volatility is the one taken from the mortgage option market. In practice, it is sufficient to take a benchmark swaption volatility from the swap market, and one usually uses a scaling factor to rescale the volatility to get the actual volatility for this correction.

Secondly, the forward CMM rate is the weighted average of the scenario CMM rate, the distribution of which is dependent on the forward distribution of TBA prices. The TBA price distribution is assumed to be relied on the probability distribution of the benchmark swap rate. The forward TBA can thus be calculated based on the following formula,

$$P_{CMM} = P_{0CMM} + D_{dura} * dX$$

where  $dX$  is a shock (or shift) to the benchmark swap curve and  $D_{dura}$  is the duration for the corresponding coupon stack. The distribution of swap rate is needed to build a scenario forward TBA price distribution; usually a normal distribution of a swap rate is assumed. From the construction of the CMM rate, we can see that the CMM rate has eliminated the negative convexity of the TBA price. Thus, the CMM rate has duration almost to one and shows almost no convexity.

## 3. Long term CMM rate calculation

The problem with the long term CMM rate construction comes from the fact that the TBA market is now available for only a few months, and thus, even for a short term forward CMM rate, some interpolation techniques should be used to get the forward TBA price. For further long term CMM rates, there is no good solution for constructing this CMM rate. The long term CMM rate

has not standardized so far and the market has no consensus on the comparability of long term CMM rate. The prevailing methodology is to use a current coupon model based on some benchmark swap rates and some volatility factors, and these model are usually then regressed through historical pricing using some prepayment model. So far, the majority of CMM market is dominated by CMM forwards.

## 4. Application of CMM product in servicing hedging

The growth of CMM products in servicing hedging comes from their advantages over traditional hedging tools. Traditionally, servicers use swap and TBA to hedge the mortgage rate risk. However, hedging with swaps introduces basis risk and hedging with TBAs brings more negative convexity into the overall portfolio. Although the aggravated convexity can be hedged again using swaptions, the new swaptions in the position will bring extra basis risk between the mortgage option volatility and swaption volatility. The traditional hedging approach also requires frequent rebalancing of the position and higher transaction cost. We can see from the above analysis, that the CMM rate does not show negative convexity compared with hedging with TBA, and also eliminates basis risk compared with hedging with swaps. Thus, using CMM products as hedging instruments, changes in a servicing portfolio due to a change of mortgage rates will be offset by changes in CMM forwards. In current hedging practice, instead of using TBAs and swaps as hedge tools, it becomes more popular for the servicers to use CMM products as hedging tools. Hedging with CMM products will neither incur extra negative convexity nor extra basis risk. Hedging with CMM products also saves transaction costs. Other applications of CMMs include their use in mortgage basis trades and carry trades.

In MIAC's new release of the *SP3 ALM* tool, we have built our CMM forward calculator. The forward CMM rates are calculated using convexity adjustment and scenario rate distribution of TBA coupon stack. MIAC's CMM calculator has been verified against results of other dealers and shows an excellent match.



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