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SIZING UP Prepayment Rate Assumptions

Buyers of servicing need to think twice about the prepayment rate assumptions they use to bid for portfolios. Knowing what goes into these assumptions is critical to realizing bargained-for returns from purchased servicing.

BY TERRANCE E. LOEBS

"I recently purchased a servicing portfolio that I priced using consensus prepayment estimates, only to see Fannie Mae report today actual speeds for some collateral coupons that were almost double my pricing speeds. Prepayment estimates are worthless."
— FRUSTRATED MORTGAGE BANKER

Purchasers and appraisers of bulk servicing portfolios know that faster-than-anticipated principal runoff quickly erodes portfolio value. They also know that the primary agents of this erosion are changing interest rate relationships.

Notwithstanding heightened interest rate volatility in recent years, a large number of servicing market participants continue to forecast static interest rates and prepayments when pricing servicing cash flows through the use of scenario-insensitive models and long-term prepayment rate estimates.

The downward bias of interest rates across the yield curve throughout most of 1991 and 1992 plainly exposed the pitfalls of relying on overly simplistic cash flow models and long-term prepayment forecasts when buying servicing. Despite recent bouts with seemingly uncontrolled portfolio bleeding, many mortgage bankers continue to base their portfolio bids on cash flow forecasts that employ long-term average estimated runoff rates as *constants*. While some long-term prepayment estimates are indeed formulated in a fashion to make their application as constants appropriate, others are clearly not designed for such use, particularly in conjunction with mortgage servicing cash flows. The result is that a significant number of companies in the servicing business have made (and will continue to make) distorted cash flow and return-on-investment forecasts with respect to their servicing acquisitions.

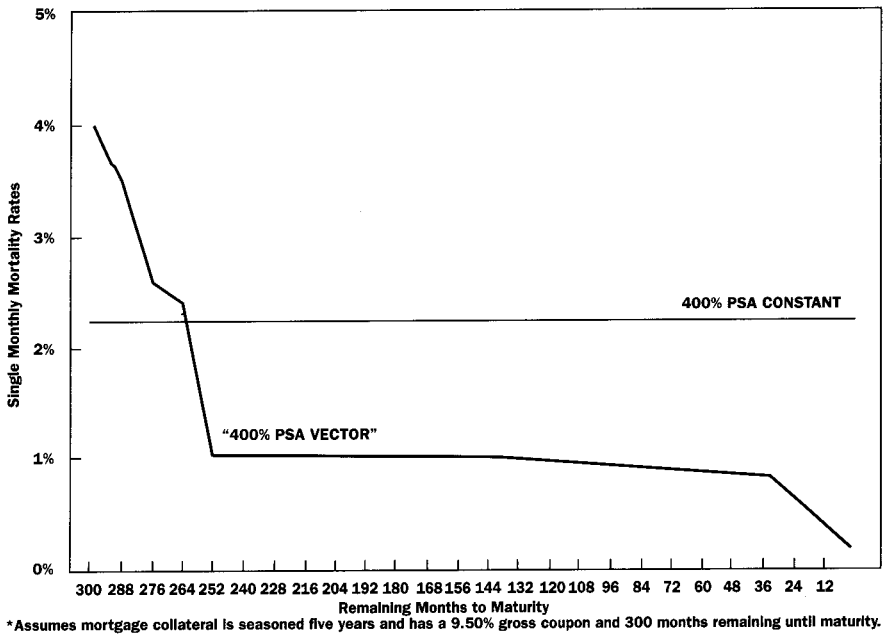
For many companies, a hyperproduction orientation and euphoria may have obscured the need to reexamine arcane asset acquisition formulas that seemed to work well enough in more staid market environments. A surprising number of mortgage bankers are frustrated because they have failed to grasp some of the tenets underlying prepayment rate definition and behavior.

Constant prepayment rates: background

In valuing mortgage pass-throughs, most market participants use traditional average life and yield computations that incorporate a constant prepayment speed over the stated term

FIGURE 1

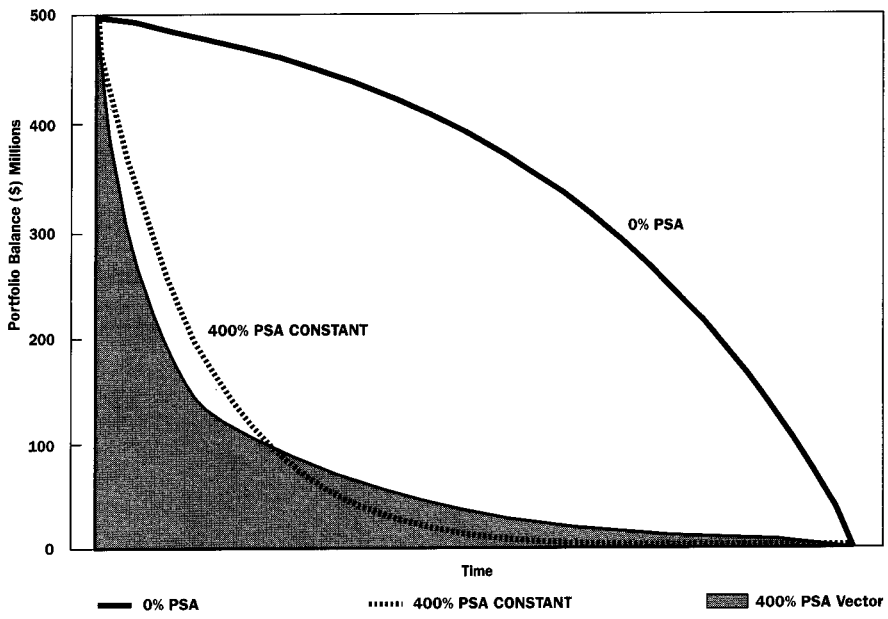
Monthly Prepayment Rate Paths
Two 400% PSA Scenarios That Produce a 3.5-Year Average Life*



*Assumes mortgage collateral is seasoned five years and has a 9.50% gross coupon and 300 months remaining until maturity.

FIGURE 2

Outstanding Principal Balance Over Time



of a loan pool. There are merits in compromising on details in the interest of making a modeling exercise practical. The application of a constant, unchanging runoff rate to any mortgage amortization schedule undoubtedly simplifies an otherwise complex cash flow modeling process.

In determining servicing portfolio value, however, skimping on prepayment details is not only impractical, but it also can compromise the fundamental soundness of planned portfolio acquisitions.

One type of prepayment rate frequently relied upon by mortgage bankers as a predictor of portfolio runoff is the "long-term average estimate," which I will refer to as the "LTA." This simple quantity is a product of sophisticated models that project period-specific prepayment (single monthly mortality) rates from the month a prepayment analysis is initiated through and until the maturity date for a given agency collateral type (Fannie Mae 8.5s, Ginnie Mae 10.0s, etc.). A unique, month-by-month prepayment "path" is forecast for each of a number of different future interest rate scenarios, including a so-called base case in which *interest rates* are assumed to remain unchanged, or stable, over time. Only the prepayment path associated with the latter (base case) scenario is used to derive the LTA. Thus, the LTA is commonly defined as the *constant* mortality rate, which, when applied to a given mortgage amortization schedule, produces an average life equal to that produced by the *varying* monthly prepayment rates projected within the context of the base case interest rate scenario (see Figure 1).

Unfortunately, when a mortgage asset with prepayment-sensitive cash flows is analyzed within an environment where anticipated near-term monthly runoff rates differ significantly from the LTA used in valuation, cash flow timing and return on investment forecasts become distorted—even if interest rates remain stable.

It must be remembered that the LTA is by definition both *long-term* in nature and *an estimate.* Because mortgage loan servicing rights are decaying assets (no recoverable principal value) with a volatile return profile, it is crucial to consider short-term and intermediate-term prepayment behavior in as precise a fashion as possible when forecasting related cash flows. Thus, assuming that one is resigned to analyzing future cash flows solely within the base case interest rate vacuum—the LTA orientation—a prepayment path that comprises the selected LTA should be considered.

While the implications of ignoring a prepayment rate path in less volatile interest rate environments might prove inconsequential, recent interest rate trends, coupled with increased availability and liquidity of shorter-term (more cheaply priced) mortgage products have accentuated the importance of considering the underlying periodic prepayment rates that comprise LTAs.

Pitfalls of applying constant prepayment rates

Purchasers of prepayment-sensitive derivative mortgage securities routinely analyze (through the use of option-adjusted spread [OAS] models or prepay-

ment vector analysis) the impact of various interest rate scenarios (and corresponding discrete prepayment paths) on investment performance. Notwithstanding value dynamics that resemble certain (interest-only) derivative securities, many mortgage bankers continue to model mortgage loan servicing cash flows using certain prepayment rates in an inappropriate context—as *constants.*

A stable interest rate scenario—the premise in deriving an LTA—in and of itself does not imply that projected *prepayment* rates remain unchanged throughout the life of the mortgage pool because demographics, defaults, loan age and mortgage product innovation also influence mortgage pool prepayments. Even more significant for servicing investors, in light of recent interest rate behavior, is that the effect of anticipated spikes in short- and intermediate-term refinancing activity get "averaged out" in the computation of LTAs. Consequently, the use of an LTA as a *constant* runoff rate when modeling servicing cash flows is fundamentally flawed because the detailed prepayment path, which affects the level of underlying principal balances over time and thus the amount of periodic servicing revenues, is ignored.

Failure to consider the effects of near-term prepayment paths in modeling servicing cash flows can ultimately leave a portfolio purchaser with significantly less cash and yield than expected, particularly when valuing servicing backed by moderately seasoned, premium coupon collateral. As an example, consider the following Fannie Mae MBS, fixed-rate servicing portfolio, the characteristics of which closely resemble a recent market offering:

Portfolio Size: $500,000,000
Loans: 4,600
Gross Coupon: 9.5 percent
Net Servicing Fee: 0.25 percent
Original Maturity: 360 months
Remaining Maturity: 300 months

In the interest of clarity, other modeling inputs, such as delinquency profile, ancillary income, costs and reinvestment rates, have been intentionally omitted here. Also, individual loan characteristics are assumed to be homogenous (obviating the need for component analysis).

Suppose that for this portfolio, the purchaser demands a minimum pretax internal rate of return (IRR) of 12 percent. Applying a 400 percent (LTA) PSA (the median of several LTA prepayment rates obtained on the bid date corresponding to conventional agency collateral with weighted average coupon, weighted average maturity and seasoning characteristics comparable to those of the subject servicing portfolio) as a *constant* to value the portfolio, a purchase price of 0.75 percent provides the minimum return desired.

A different look

Let's take a different look at what the long-term average PSA estimate of 400 percent may imply. To keep the illustration simple, we will derive a near-term prepayment path or "vector" that employs a distinct runoff rate by year (instead of a more precise and technically correct *month-by-month* path). By applying even this crude prepayment vector (the "long-term average" of which is 400 percent PSA) to the servicing port-

FIGURE 3

Incremental Servicing Revenue
400% PSA Vector vs. 400% PSA Constant

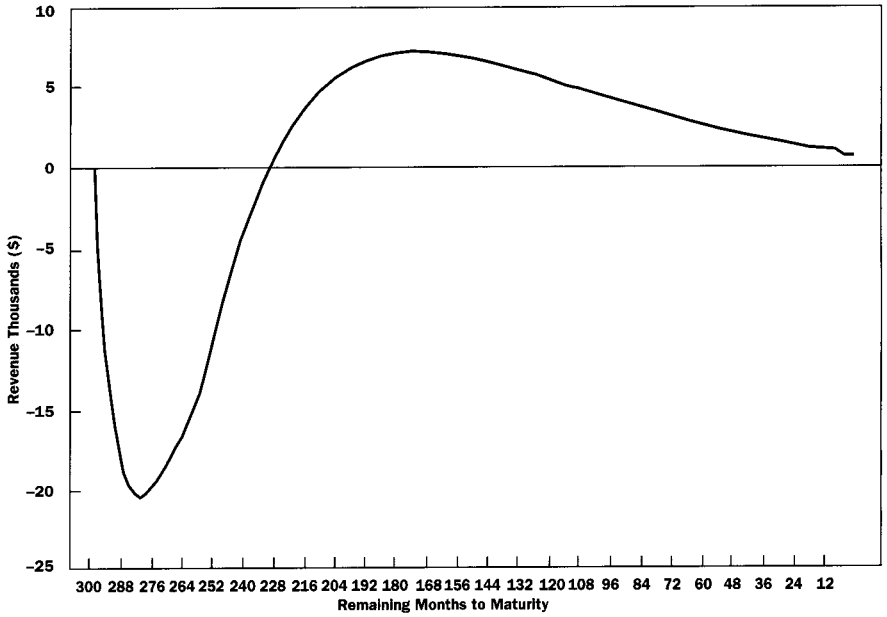
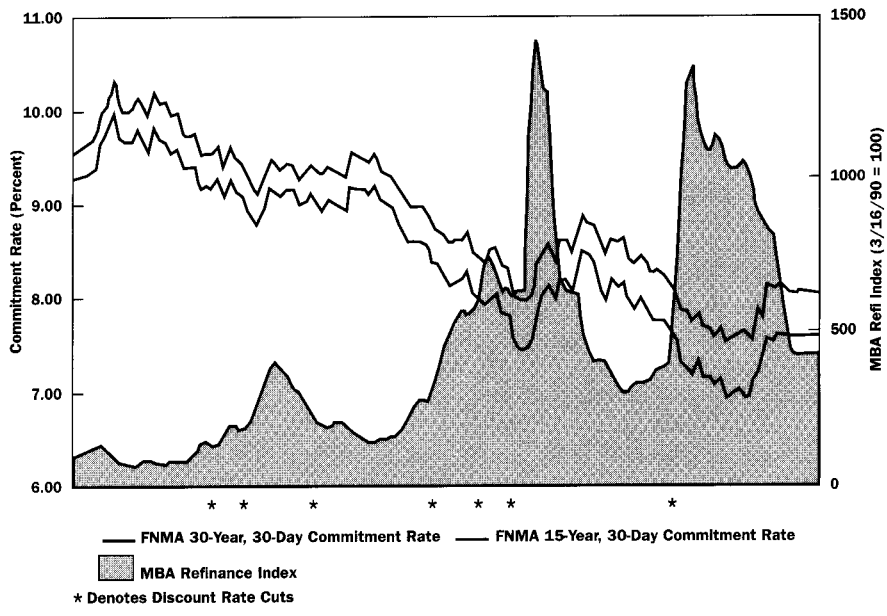


FIGURE 4

Recent Mortgage Rates and Refinance Activity
August 1990–November 1992



folio's cash flows, one can appreciate the potential pitfalls in relying on LTAs as constant factors.

For example, suppose that the following simplified prepayment "vector" underlies the 400 percent PSA long-term average:

Initial PSA: 650 percent
Beginning Yr 2 PSA: 575 percent
Beginning Yr 3 PSA: 450 percent
Beginning Yr 4 PSA: 425 percent
Beginning Yr 5 PSA Until Maturity: 200 percent
Long-term Average = 400 percent PSA

Using the same model and inputs as the previous example, but applying the above 400 percent PSA vector instead of the 400 percent PSA constant to the servicing portfolio's principal balances, the purchaser would have calculated a pretax IRR of only 8.35 percent at the same 0.75 percent purchase price. This represents a return that is 30 percent less than what had been forecast using the LTA as a constant prepayment rate.

Figures 2 and 3 illustrate the implications of applying a 400 percent PSA constant and a 400 percent PSA vector to the subject portfolio. Although the average life of the portfolio is three and one-half years in both scenarios, faster portfolio run-off in the near term (associated with the vector approach) results in a significantly less valuable servicing revenue stream.

The "constant" rationale

There are a number of reasons why the practice of applying a constant prepayment rate methodology in valuing servicing rights has escaped scrutiny historically. Those reasons are:

- Some pricers of servicing do not recognize the pitfalls in employing certain LTA rates as constants when projecting a servicing portfolio's cash flow stream.
- Month-by-month prepayment vectors are not readily available because most traditional (Wall Street) sources of this data consider it proprietary. Most prepayment constants are dealer-provided and by-products of highly sophisticated computer algorithms, cash flow and return-on-investment projections. So, using even a snapshot version of the modeling output—the long-term average estimate—is often interpreted as being conservative because the cash flow model's runoff factor was obtained from an unbiased source.
- Many professionals who price servicing, while appreciating the implications of variable prepayment behavior over time, choose to avoid introducing further complexity into the admittedly arcane servicing cash flow modeling process. Modeling servicing portfolio cash flows is quite complex even when assuming static interest rates (and prepayments). The integration of dynamic (Option Adjusted Spread-like) processes into traditional servicing models requires significant system resources.
- Because the market for mortgage servicing rights historically has been an inefficient one, efforts to strive for pricing precision have been relatively muted.
- In preparing portfolio bids, servicing purchasers have traditionally been more concerned with assessing prevailing market yields and refining servicing cost estimates than with researching the source and derivation of prepayment rates.
- Many market players compensate for significant divergences between static long-term average prepayment estimates and personal projected near-term runoff rates by subjectively adjusting a constant average rate. Although far from scientific, this sort of approach has admittedly produced acceptable results for some in less volatile interest rate environments.
- "Multiple scenario analysis" (an expected value pricing approach employing a limited number of interest rate scenarios and corresponding probabilities) is used by a number of market participants. While most such expected value pricing models represent a vast improvement over traditional single-scenario models, potential outcomes modeled are few and probability assessment is often arbitrary. Further, the prepayment rates used in conjunction with the individual, "parallel-shifted" (plus or minus x basis points across the entire base case yield curve) interest rate scenarios are typically long-term constants.
- Certain regulatory guidelines regarding the valuation of servicing portfolio cash flows include the recommended use of prepayment constants. For example, the Office of Thrift Supervision (OTS) has mandated that thrift institutions "mark-to-market" their purchased mortgage servicing rights (PMSRs). Among the guidelines stipulated by the OTS to determine PMSR market value is the use of a prepayment assumption based on a "long-term consensus" or "average" prepayment estimate.
- The use of long-term average prepayments as constants in servicing pricing decisions has historically had less severe implications for purchasers' cash flow and yield projections because mortgage rates typically do not fall as far and as fast as they have in the recent past. The concomitant surges in borrower refinancing activity have heightened the amplitude of *near-term* prepayments to unprecedented levels (see Figure 4).

Nobody can know precisely how prepayments will behave prospectively until crystal ball technology is perfected.

Conclusions

A complex web of catalysts that include interest rate relationships, loan-to-value ratios, loan program types and demographics influences a prepayment forecast. While sophisticated computer algorithms have been developed to assist mortgage investors in predicting prepayment behavior, nobody can know precisely how prepayments will behave prospectively until crystal ball technology is perfected.

Among other things, these facts point to a need for a wider understanding and acceptance by mortgage bankers of ser-

vicing insurance products available in today's marketplace. In recent years, many innovative hedging vehicles have been developed for servicers that entail little or no basis risk. Perhaps the most popular type of "derivative" hedge to emerge is prepayment caps. These are tailored to fit specific servicing portfolios in order to effectively hedge either cash flow or book value, or both. Any mortgage banking enterprise that has been unable to replace runoff with new originations should investigate the feasibility of implementing a derivative insurance product.

Faced with complexity and uncertainty, mortgage bankers entrusted with modeling servicing cash flows are ultimately forced to sacrifice varying degrees of pricing precision for practicality. The most viable compromise for many market participants is an expected value application known as "multiple scenario analysis." While a pricing methodology that incorporates multiple interest rate scenarios may be superior to single-scenario analysis in diminishing servicing pricing risk, multiple scenario pricing still requires several (other than base case) prepayment constants for each collateral type comprising a given portfolio. Assuming that prepayment rates are available from a reliable source for each scenario, the technical limitations described earlier remain in most of these models.

Some mortgage market observers comment that because a given servicing portfolio's unique characteristics are incomparable to the more generic mortgage collateral pools upon which LTAs are based, and because the LTAs themselves are derived from an unrealistic (i.e., stable) interest rate scenario, long-term average prepayment rates are "worthless" in forecasting servicing portfolio cash flows. The latter perception has been compounded by the effects of an expanding menu of borrower refinancing alternatives and mortgage product innovations, including "no-point refis," which have undoubtedly wreaked havoc with even the most diligent prepayment research and projections.

Despite these concerns, the fact remains that mortgage-related transactions—servicing portfolio acquisitions included—require some form of prepayment projection in order to forecast cash flow and return. Even if alternative prepayment estimates are unavailable, LTAs can still serve as useful reference points for most mortgage market participants.

Although simple in appearance, LTAs are actually products of intensive analysis spearheaded by professionals with doctorates in math and economics who are trained to interpret and extrapolate numbers and make well-informed forecasts. When viewed within its appropriate context, LTAs can serve as useful benchmarks for servicing investors lacking sophisticated (Option-Adjusted Spread-like) modeling tools.

Unfortunately, many servicing market participants who are relegated to using prepayment constants in valuing portfolios due to technical and/or practical concerns, continue to ignore the derivation and relevance of the prepayment rates they rely upon, or downplay the significance of more thorough prepayment analysis when purchasing portfolios in a volatile interest rate environment.

Servicing pricers who use "average life equivalent" prepayment rates, such as the LTA—*and understand their derivation*—should be motivated to apply a logical prepayment vector to servicing cash flows. For single-scenario pricers in particular, cognizance that an LTA is made up of a prepayment path is critical.

Unfortunately, there is no formula to "reverse engineer" an LTA because an infinite number of path combinations can be inferred from a given LTA. To eliminate random guesswork that might otherwise evolve in an attempt to derive a prepayment path or vector from an LTA, interested parties should investigate the feasibility of the following:

- Procuring vectors from third-party prepayment experts;
- Purchasing "advance factors" from a vendor;
- Building customized vectors by combining logical inferences from the characteristics of a specific portfolio with prepayment theory.

Although servicing portfolio characteristics can be quantified easily enough, the sheer number of (and interaction between) loan-specific characteristics that can influence a prepayment forecast promotes a diversity of prepayment opinion—in even a base case (stable interest rate) environment. Because of this, several independent opinions should be sought from knowledgeable sources within the servicing arena or mortgage securities industry to assess the collective influence that a given portfolio's attributes might have on future runoff.

The theoretical aspect of vector construction is more objective. The stable interest rate assumption (that implies that the economic incentive for borrowers to refinance will not change with time) used in computing LTAs, coupled with the burnout phenomenon (the tendency of prepayments to diminish with time following the very early months of a loan), means that for even moderately seasoned mortgage collateral, monthly prepayment rates will be faster than the average rate in the near-to-intermediate term and slower than the average rate later. Thus, given a stable or downward trend in actual interest rates, all servicing portfolios—with the exception of those backed by mortgage originations that are new or very old—should be priced using a prepayment path that incorporates near-term runoff rates that exceed the selected LTA. **MB**

Terrance E. Loebs is associate director of financial institutions at Ladenburg, Thalmann & Co. Inc., in New York City.