

Modeling Mortgage Risk: Definitional Issues

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1. Introduction

In the February issue of *The Pipeline*, we provided a general overview of the issues involved in *loan level* modeling of *both* major components of mortgage risk – prepayment and default. We discussed the non-agency mortgage market and outlined a brief history of the analytical frameworks used to capture these risks, including competing risks hazard models.

In this issue of *The Pipeline*, we begin our discussion of the AD&Co methodology for loan-level modeling of mortgage risk by starting with some important definitional issues. In order to successfully build models of mortgage risk that capture prepayment, delinquency and default behavior, we must decide upon common, generally accepted definitions for each of these behaviors. This article discusses the two standards for measuring mortgage delinquency. We then offer up two definitions of default, based upon various levels of delinquency. Finally, we discuss the implications that our default definitions have for a loan-level definition of prepayment.

2. Definitions of Delinquency

Delinquency is a mandatory precursor to an event of default and plays an important role in the definition of default. From the primary market perspective, for example, delinquency status on previous mortgages helps shape the “paper grade” of subprime mortgages. For secondary market investors, delinquency status determines “trigger” values that determine cash flows to subordinate bonds. Also, a prepayment event occurring while in a delinquency state obviously may have different motivations than prepayment on a current loan. Therefore, our first task is to clearly understand the standards for measuring delinquency.

Delinquency seems rather easily defined – a borrower either makes the scheduled payment or does not. Since mortgages typically have monthly payments, a borrower who misses one payment would be 30 days late; a borrower who misses two payments would be 60 days late, etc. Thus, “delinquency status” is a *count of the number of payments currently missing*.

However, it turns out that there are two standards for reporting delinquency status. The first is known as the OTS/FFIEC rule.¹ Essentially, a loan increases its delinquency status if a monthly payment is not received by *the loan’s due date in the following month*. The second standard is known as the Mortgage Bankers Association (MBA) method.² In this calculation, a loan increases its delinquency status if a monthly payment is not received by *the end of the day immediately preceding the loan’s next due date*.

¹ See the Thrift Financial Report (TFR) Instruction Manual, “Schedule PD – Consolidated Past Due and Nonaccrual” (June 2003), <http://www.ots.treas.gov>; and the FFIEC Call Report Instructions, Schedule RC-N, <http://www.ffiec.gov>.

² The MBA method is a convenient name adopted by the primary mortgage market for a standard practice in use long before the OTS/FFIEC standard came into being.

Consider the following example of a current loan with a payment due on April 1. With no payment received by April 30, the loan would be 1 month (30 days) delinquent as of the May reporting cycle under the MBA method, whereas the OTS/FFIEC method still would show the loan as current. With no payment received by May 31, the loan would be 2 months (60 days) delinquent as of the June reporting cycle under the MBA method, and 1-month (30 days) delinquent under the OTS/FFIEC method. In short, a borrower that misses one payment is current under the OTS method and 1-month delinquent under the MBA method.

This measurement distinction is important because the *MBA calculation is the standard in the "prime" mortgage markets*, while the *OTS calculation is the standard used in "non-prime" (subprime, Alt-A, home equity, etc.) markets*. The implication for modeling mortgage risk is that "delinquency status" is not directly comparable for prime and non-prime loans. Therefore, to accurately forecast mortgage behavior, we must segment our models into at least these two groups.³

Another important element of "delinquency status" definitions is the notion of "rolling delinquencies" or "payment velocity." It is possible for "delinquent" borrowers to resume making current payments without making up for past missed payments. In this regard, a CSFB research report demonstrated two important points:⁴

- "A significant percentage of delinquent loans are cash flowing. Therefore, the high delinquencies of seasoned subprime deals don't directly translate into losses."
- "Over the 18-month period that we analyzed, the cumulative default rates are significantly lower for loans that are cash flowing, regardless of the delinquency status."

These points highlight the *incompleteness* of a count variable like "delinquency status" as a summary statistic for delinquency behavior.

For example, it is not immediately obvious which borrower should be considered "worse" from an overall delinquency standpoint: one who is 3 payments behind but made the most recent 4 payments; or one who is 2 payments behind today. It is clear that primary and secondary market participants would benefit from knowing *when* the missed payments occurred. It may be that the *pattern* of missed payments also contains information. AD&Co is actively pursuing research into a practical but rigorous method to capture the additional information in delinquency status.

3. Definitions of Default

Given our two standards for calculating delinquency, our next task is to come up with a definition of "default." The definition of default will be a major task as we pursue the creation of industry-standard models of prepayment and default. We will argue that models

³ A forthcoming article in *The Pipeline* will discuss the issue of "model segmentation" in more detail, as well as discuss various mortgage market taxonomies (i.e., "prime", "Alt-A", "home equity", etc.).

⁴ See Dubitsky, et. al. (April 2004) – "Payment Velocity: Are your Delinquent Borrowers' Payments Flow'n or Slow'n?" Credit Suisse First Boston (CSFB).

of mortgage risk need to include at least two definitions of default – one for primary market institutions such as banks and thrifts and the other for secondary market investors.

Primary market financial institutions such as banks and thrifts, follow accrual-style accounting rules for determining default. The Federal Financial Institutions Examinations Council (FFIEC) coordinates the activities of U.S. regulators. One possible definition of default (“charge off”) for mortgages is the following FFIEC credit classification:⁵

- The obligor is past due more than 180 days on any open-end credit obligation; or the obligor is past due more than 120 days on any closed-end credit obligation.
- The loan balance exceeds the current value of the property, less cost to sell.
- The obligor enters bankruptcy (within 60 days of notification).

Foreclosure is not mentioned specifically in the FFIEC rules. However, since the lender initiates foreclosure, classifying a loan in foreclosure is tantamount to the lender declaring the loan to be in default.

Charging off a loan, or classifying it as a loss, is just one possible default definition. In addition to the document above, FFIEC also defines “nonaccrual status” as the following:⁶

- “Nonaccrual Status: This entry covers, for purposes of these reports, the criteria for placing assets in nonaccrual status (presented in the general rule below) and related exceptions, the reversal of previously accrued but uncollected interest, the treatment of cash payments received on nonaccrual assets and the criteria for cash basis income recognition, the restoration of a nonaccrual asset to accrual status, and the treatment of multiple extensions of credit to one borrower.”
- “General rule – Banks shall not accrue interest, amortize deferred net loan fees or costs, or accrete discount on any asset (1) which is maintained on a cash basis because of deterioration in the financial condition of the borrower, (2) for which payment in full of principal or interest is not expected, or (3) upon which principal or interest has been in default for a period of 90 days or more unless the asset is both well secured and in the process of collection.”
- “An asset is “well secured” if it is secured (1) by collateral in the form of liens on or pledges of real or personal property, including securities, that have a realizable value sufficient to discharge the debt (including accrued interest) in full, or (2) by the guarantee of a financially responsible party. An asset is “in the process of collection” if collection of the asset is proceeding in due course either (1) through legal action, including judgment enforcement procedures, or, (2) in appropriate circumstances, through collection efforts

⁵ See the FFIEC Uniform Retail Credit Classification and Account Management Policy (June 2000), http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=2000_register&docid=00-14704-filed.pdf

⁶ See FFIEC: Reports of Condition and Income Instructions - Glossary (March 2005) http://www.fdic.gov/regulations/resources/call/crinst/callinst2005_March.html

not involving legal action which are reasonably expected to result in repayment of the debt or in its restoration to a current status in the near future.”

AD&Co has reviewed the various FFIEC rules and other sources in order to come up with a reasonable default definition for mortgages from the perspective of primary market participants. We propose, then, a “*primary market default definition*” for mortgage loans include any loan that in the current month is 4 or more months past due (120 DPD), or 5 or more months past due (180 DPD) for mortgage lines-of-credit; or any loan that entered foreclosure or REO in the prior month.

In contrast to primary market portfolio holders, secondary market investors (and the issuers that participate in these non-agency markets) define default based upon a different standard, outlined primarily in a publication put out by an industry trade association called the Bond Market Association (BMA):⁷

- “Default analysis is intended to model defaults only, not delinquencies. Delinquent loans that are cured will not be part of this analysis. For this purpose, a loan in default is one that no longer pays principal and interest and then remains delinquent until liquidated.”
- “Default analysis specifies default rates, not loss rates. Loss rates (i.e., “Loss Severities”) are specified separately.”

In essence, then, one possible “*secondary market default definition*” is a mortgage loan that no longer pays principal and interest, and then remains delinquent until liquidated.

With regard to the secondary market default definition, note that investors such as a hedge fund or an insurance company access a reasonably liquid secondary market for both agency and non-agency MBS or ABS. In these secondary markets, they observe traded prices for similar if not identical securities to those held in their portfolio. Consequently, secondary market investors focus principally on the impact prepayment and default have on the *value* of their mortgage-related investments (in other words, cash accounting).

In contrast, financial intermediaries like banks and thrifts, in addition to their secondary market investments, originate and sometimes hold whole loans in their portfolio. Since traded prices for whole loans are not widely available, these loans are considered illiquid assets. As a result, primary market institutions typically focus on the *earnings* effects of prepayment and default (in other words, accrual accounting) with respect to their “banking book” (illiquid whole loans), while retaining a value focus for their “trading book” (MBS & ABS securities).

4. Definition of Prepayment

While the two default definitions discussed above clearly differ, they also are incomplete. The deficiencies come to light when one considers possible definitions for prepayment. One possible interpretation of the secondary market default definition suggests that a “default” is

⁷ Quoted material is from the Uniform Practices Manual (1999), p. SF-16-18, Bond Market Association (BMA). The “Uniform Practices Manual” is a BMA publication providing trading, clearance and settlement guidelines representing common industry practice.

a loan which has an unpaid balance of zero this period, *and* which was in foreclosure or REO in the previous period (“delinquent until liquidated”). This default definition implies the following *prepayment* definition – a loan with an unpaid balance of zero this period which was *not* in foreclosure or REO in the previous period. However, many loan level data sets do not have the foreclosure or REO information. For example, loan-level data provided by Intex⁸ treats all loans reporting a zero balance in a given period as prepaid; unfortunately, one cannot separate prepayment from default with such data.

In addition, this very broad prepayment definition encompasses prepayments from very severe delinquency states (i.e., 150+). Mortgage servicers increasingly have come to rely upon various forms of “loss mitigation” processes that compel the borrower to sell their home in order to avoid costs. Most industry participants likely would consider these “short sales” to be more like defaults than prepayments.

Bear Stearns recently produced an important study⁹ whose “goal ... was to arrive at a set of reasonable rules that separate all zero balance loans in any given reporting period into those that were ‘true’ prepayments, with their complement being ‘true’ defaults.” The Bear Stearns study derived an “implied” default rule which “classified as a default any loan that reports a zero balance in the current month and (a) was in foreclosure or REO status in the prior month, or (b) was five or more months delinquent and non-performing in the prior month.” Although essentially arbitrary, the Bear Stearns study proposes a very reasonable dividing line between prepayments and defaults that makes the critical distinction between the two events very clear.

We would propose to modify the Bear Stearns approach to produce a *secondary market default definition*, along with a complementary prepayment definition. We suggest that a default, from a secondary market perspective, should be considered:

- (a) any loan that reports a zero balance in the current month; and
- (b) the loan was in foreclosure or REO status in the prior month, or
- (c) the loan was four or more months (120 DPD) delinquent.

A corresponding *secondary market prepayment definition* would be any loan meeting condition (a), and not meeting condition (b) or (c). This enhanced BMA definition tries to hew as closely as possible to the FFIEC rules to avoid creating a third different default standard.

It also removes the “non-performing” requirement from the Bear Stearns version. The Bear Stearns definition of “non-performing” includes loans which have missed 2 out of 3 payments in the last 3 months, or 3 out of 6 payments in the last 6 months. While this “payment velocity”-type delinquency information may improve a default definition, it is not clear that a “delinquency string” of the past 3, 6, or 12 months will always be available in a given loan-level data set. Therefore, we choose to omit this “non-performing” qualifier until further research answers the question of data availability.

⁸ Intex (<http://www.intex.com>) provides data and software for the structured fixed-income market. Their CMO Library provides loan-level collateral information for some non-agency MBS and ABS.

⁹ See Sinha, et. al. (2005) – “ABS/MBS Performance Summaries: 1st Quarter 2005”; Bear, Stearns & Co.

With regard to the secondary market default definition, prepayment seems well defined. The *secondary market prepayment definition* includes any loan less than 120 DPD with a zero balance in the current month. Note that the primary market default definition does *not* require the balance equal zero in the current month.

Thus, the primary market default precedes a secondary market default. Under the less restrictive primary market definition, the bank charges off the loan at 4+ months delinquent (the default event), and recognizes an initial amount of loss at that point (an amount that can grow, but not shrink). The table below summarizes the primary market and secondary market definitions that AD&Co proposes to utilize in its modeling efforts.

| | <u>Default</u> | <u>Prepayment</u> |
|-------------------------------------|--|--|
| <u>Primary Market Definitions</u> | any loan that in the current month is 4 or more months past due (120 DPD), or 5 or more months past due (180 DPD) for lines-of-credit; <i>or</i> any loan that enters foreclosure or REO status in the prior month | any loan that in the current month is less than 4 months past due (120 DPD), or less than 5 months past due (180 DPD) for lines-of-credit, <i>and</i> a zero balance in the current month |
| <u>Secondary Market Definitions</u> | any loan that reports a zero balance in the current month, <i>and</i> the loan was in foreclosure or REO status in the prior month, <i>or</i> the loan was four or more months (120 DPD) delinquent. | any loan that reports a zero balance in the current month, <i>and</i> the loan was not in foreclosure or REO status in the prior month, <i>and</i> the loan was less than four months past due (120 DPD) |

The implication for modeling mortgage risk seems clear. Primary market-based models should show higher defaults and lower severities than secondary market-based models.¹⁰ However, it is likely that the present value of the expected loss will be the same. We believe that multiple models will be necessary to meet the needs of *both* primary and secondary market participants.

¹⁰ From a modeling perspective, the primary market default event is treated as final (an “absorbing state”). The small number of loans that completely cure after entering primary market default therefore must be treated as new loans.