Chapter 2
Cashflow Modelling

2.1 Introduction

The modelling of the cashflows in a securitisation deal consists of two parts: the modelling of the cash collections from the asset pool and the distribution of the collections to the note holders and other transaction parties.

The first step is to model the cash collections from the asset pool, which depends on the behaviour of the pooled assets. This can be done in two ways: with a top–down approach, modelling the aggregate pool behaviour; or with a bottom–up approach, modelling each individual loan. For the top–down approach, one assumes that the pool is homogeneous, that is, each asset behaves as the average representative of the assets in the pool (a so called *representative line analysis* or *repline analysis*). For the bottom–up approach, one can choose to use either the representative line analysis or to model each individual loan (so called *loan level analysis*). If a top–down approach is chosen, the modeller has to choose between modelling defaulted and prepaid assets or defaulted and prepaid principal amounts, i.e., to count assets or money units.

On the liability side one has to model the waterfall, that is, the distribution of the cash collections to the note holders, the issuer, the servicer and other transaction parties.

In this section, we make some general comments on the cashflow modelling of securitisation deals.

2.2 Asset Behaviour

The assets in the pool can be categorised as performing, delinquent, defaulted, repaid and prepaid. A *performing asset* is an asset that pays interest and principal in time during a collection period, i.e. the asset is current. An asset that is in arrears with one or several interest and/or principal payments is *delinquent*. A delinquent asset can

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be cured, i.e. become a performing asset again, or it can become a *defaulted* asset. Defaulted assets go into a recovery procedure and after a time lag, a portion of the principal balance of the defaulted assets are recovered. A defaulted asset is never cured, it is removed from the pool once and for all. When an asset is fully amortised according to its amortisation schedule, the asset is *repaid*. Finally, an asset is *prepaid* if it is fully amortised prior to its amortisation schedule.

The cash collections from the asset pool consist of *interest collections* and *principal collections* (both scheduled repayments, unscheduled prepayments and recoveries). There are two parts of the modelling of the cash collections from the asset pool. Firstly, the modelling of performing assets, based on asset characteristics, such as initial principal balance, amortisation scheme, interest rate and payment frequency and remaining term. Secondly, the modelling of the assets becoming delinquent, defaulted and prepaid, based on assumptions about the delinquency rates, default rates and prepayment rates together with recovery rates and recovery lags.

The characteristics of the assets in the pool are described in the Offering Circular and a summary can usually be found in the rating agencies pre-sale or new issue reports. The aggregate pool characteristics described are among others the total number of assets in the pool, current balance, weighted average remaining term, weighted average seasoning and weighted average coupon. The distribution of the assets in the pool by seasoning, remaining term, interest rate profile, interest payment frequency, principal payment frequency, geographical location, and industry sector, are also given. Out of this pool description the analyst has to decide whether to use a representative line analysis assuming a homogeneous pool, to use a loan-level approach modelling the assets individually or take an approach in between modelling sub-pools of homogeneous assets. In this book, we focus on large portfolios of assets, so the homogeneous portfolio approach (or homogeneous sub-portfolios) is the one we have in mind.

For a homogeneous portfolio approach, the average current balance, the weighted average remaining term and the weighted average interest rate (or spread) of the assets are used as input for the modelling of the performing assets. Assumptions on interest payment frequencies and principal payment frequencies can be based on the information given in the offering circular.

Assets in the pool can have fixed or floating interest rates. A *floating interest rate* consists of a base rate and a margin (or spread). The base rate is indexed to a reference rate and is reset periodically. In the case of floating rate assets, the weighted average margin (or spread) is given in the offering circular. Fixed interest rates can sometimes also be divided into a base rate and a margin, but the base rate is fixed once and for all at the closing date of the loan receivable.

The scheduled repayments, or amortisations, of the assets contribute to the principal collections and have to be modelled. Assets in the pool might amortise with certain payment frequency (monthly, quarterly, semi-annually, annually) or be of the bullet type, which means that all principal is paid back at the scheduled asset maturity, or be any combination of these two (soft bullet).

The modelling of non-performing assets requires default and prepayment models which take as input, assumptions about delinquency, default, prepayment and recovery rates. These assumptions have to be made on the basis of historical data, geographical distribution, obligor and industry concentration, and on assumptions about the future economical environment. Several default and prepayment models will be described in the next chapters.

We end this section with a remark about delinquencies. *Delinquencies* are usually important for a deal's performance. A delinquent asset is usually defined as an asset that has failed to make one or several payments (interest or principal) on scheduled payment dates. It is common that delinquencies are categorised in time buckets, for example, in $30+(30-59)$, $60+\ (60-89)$, $90+(90-119)$ and $120+(120-)$ days overdue. However, the exact timing as to when a loan becomes delinquent and the reporting method used by the servicer, will be important for the classification of an asset to be current or delinquent and also for determining the number of payments past due, see [1].

2.2.1 Example: Static Pool

As an example of cashflow modelling, we will look at the cashflows from a static, homogeneous asset pool of loan receivables.

We model the cashflows monthly and denote by t_m, $m = 0, 1, \ldots, m_T$ the payment date at the end of month m, with $t_0 = 0$ being the closing date of the deal and $t_{m_T} = T$, being the legal final maturity date.

The cash collections each month from the asset pool consist of interest payments and principal collections (scheduled repayments and unscheduled prepayments). These collections constitute, together with the principal balance of the reserve account, available funds.

The number of performing loans in the pool at the end of month m will be denoted by $N(m)$. We denote by $n_D(m)$ and $n_P(m)$ the number of defaulted loans and the number of (unscheduled) prepaid loans, respectively, in month m. The following relation holds true for all m:

$$N(m) = N(m-1) - n_D(m) - n_P(m). \tag{2.1}$$

The first step is to generate the scheduled outstanding balance of and the cashflows generated by a performing loan. After this is done, one can compute the aggregate pool cashflows.

Performing Loan Balance

The outstanding principal amount of an individual loan at the end of month m, after any amortisation, is denoted by $B_C^{(L)}(m)$, where the C stands for current. This amount is carried forward to the next month and is, therefore, the current outstanding principal balance at the beginning of (and during) month $m+1$. Denote by $B_A^{(L)}(m)$ the scheduled principal amount repaid (A stands for amortised) in month m. The outstanding principal amount at the end of month m:

$$B_C^{(L)}(m) = B_C^{(L)}(m-1) - B_A^{(L)}(m). \tag{2.2}$$

Defaulted Principal

Defaulted principal is based on the previous months ending principal balance times the number of defaulted loans in the current month:

$$P_D(m) = B_C^{(L)}(m-1)n_D(m). \tag{2.3}$$

Interest Collections

Interest collected in month m is calculated on performing loans, i.e., the previous months ending number of loans less the defaulted loans in the current month:

$$I(m) = (N(m-1) - n_D(m))B_C^{(L)}(m-1)r_L, \tag{2.4}$$

where r_L is the loan interest rate. It is assumed that defaulted loans pay neither interest nor principal.

Principal Collections

Scheduled repayments are based on the performing loans from the end of previous month less defaulted loans:

$$P_{SR}(m) = (N(m-1) - n_D(m))B_A^{(L)}(m), \tag{2.5}$$

where $B_A^{(L)}(m)$ is the scheduled principal amount paid from a single loan at the end of month m.

Prepayments are equal to the number of prepaid loans times the ending loan balance. This means that we first let all performing loans repay their scheduled principal, and then we assume that the prepaying loans pay back the outstanding principal after scheduled repayment has taken place:

$$P_P(m) = B_C^{(L)}(m)n_P(m), \tag{2.6}$$

where:

$$B_C^{(L)}(m) = B_C^{(L)}(m-1) - B_A^{(L)}(m). \tag{2.7}$$

The current outstanding balance of the asset pool after defaults, prepayments and repayments is:

$$B_C^{(P)}(m) = N(m) B_C^{(L)}(m). \tag{2.8}$$

where the total number of loans in the pool is:

$$N(m) = N(m-1) - n_D(m) - n_P(m). \tag{2.9}$$

Recoveries

We will recover a fraction of the defaulted principal after a time lag, T_{RL}, the recovery lag:

$$P_{\text{Rec}}(m) = P_D(m - T_{RL}) RR(m - T_{RL}), \tag{2.10}$$

where RR is the Recovery Rate.

Available Funds

The available funds in each month, assuming that total principal balance of the cash reserve account ($B^{(CR)}$) is added, is:

$$A_F(m) = I(m) + P_{SR}(m) + P_P(m) + P_{\text{Rec}}(m) + B^{(CR)}(m). \tag{2.11}$$

In this example, we assume that these available funds are distributed according to a combined waterfall. In a structure with separate interest and principal waterfalls, we have interest available funds and principal available funds instead.

Total Principal Reduction

The total outstanding principal amount of the asset pool has decreased with:

$$P_{\text{Red}}(m) = P_D(m) + P_{SR}(m) + P_P(m), \tag{2.12}$$

and to make sure that the notes remain fully collateralised, we have to reduce the outstanding principal amount of the notes with the same amount.

2.2.2 Revolving Structures

A revolving period adds an additional complexity to the modelling because new assets are added to the pool. Typically, each new subpool of assets should be handled

Table 2.1 Example waterfall

Payment Item
(1) Senior expenses
(2) Class A interest
(3) Class B interest
(4) Class A principal
(5) Class B principal
(6) Reserve account reimbursment
(7) Residual payments

individually, modelling defaults and prepayments separately, because the assets in the different subpools will be in different stages of their default history. Default and prepayment rates for the new subpools might also be assumed to be different for different subpools.

Assumptions about the characteristics of each new subpool of assets added to the pool have to be made in view of interest rates, remaining term, seasoning, and interest and principal payment frequencies. To do this, the pool characteristics at closing together with the eligibility criteria for new assets given in the offering circular can be of help.

2.3 Structural Features

The key structural features discussed in Chap. 1: structural characteristics, priority of payments, loss allocation, credit enhancements and triggers, all have to be taken into account when modelling the liability side of a securitisation deal. Also, basic information on the notes, such as legal final maturity, payment dates, initial notional amounts, currency and interest rates is of importance. The structural features of a deal are detailed in the *offering circular*.

The following example describes a basic waterfall in a transaction with two classes of notes.

2.3.1 Example: A Two-Note Structure

Assume that the asset pool described earlier in this chapter is backing a structure with two classes of notes: A (senior) and B (junior). The Class A notes constitute 80 % of the initial amount of the pool, and the Class B notes 20 %.

The waterfall of the structure is presented in Table 2.1. The waterfall is a so-called combined waterfall, where the available funds at each payment date constitute both interest and principal collections.

(1) Senior Expenses

On the top of the waterfall are the senior expenses which are payments to the transaction parties that keep the transaction functioning, such as the servicer and the trustee. In our example, we have aggregated all these expenses into one item, *Senior expenses*. These expenses are assumed to be based on the ending asset pool principal balance in the previous month, multiplied by the servicing fee rate. To this amount, we add any shortfall in the servicing fee from the previous month. The senior expenses due to be paid is:

$$I_{\mathrm{Due}}^{(Sr)}(m) = B_C^{(P)}(m-1)i_f^{(Sr)} + I_{SF}^{(Sr)}(m-1)\left(1 + r_{SF}^{(Sr)}\right), \tag{2.13}$$

where $B_C^{(P)}(m-1)$ is the current outstanding pool balance carried forward from the end of month $m-1$, $i_f^{(Sr)}$ is the (monthly) issuer fee (expressed as a per cent of the outstanding pool balance), $I_{SF}^{(Sr)}(m-1)$ is the shortfall (i.e. unpaid fees) in previous month and $r_{SF}^{(Sr)}$ is the (monthly) interest rate on any shortfall.

The actual amount paid depends on the available funds, $A_F(m)$ defined in (2.11):

$$I_P^{(Sr)}(m) = \min\left(I_{\mathrm{Due}}^{(Sr)}(m), A_F(m)\right). \tag{2.14}$$

After the senior expenses have been paid, we calculate any shortfall and update available funds. The shortfall is the difference:

$$I_{SF}^{(Sr)}(m) = I_{\mathrm{Due}}^{(Sr)}(m) - I_P^{(Sr)}(m). \tag{2.15}$$

The available funds are either zero or the initial available funds, less the senior expenses paid, whichever is greater:

$$A_F^{(1)}(m) = \max\left(0, A_F(m) - I_P^{(Sr)}(m)\right). \tag{2.16}$$

We use the superscript (1) in $A_F^{(1)}(m)$ to indicate that it is the available funds after item 1 in the waterfall.

(2) Class A Interest

The *Class A Interest Due* is based on the current outstanding principal balance of the A notes at the beginning of month m, i.e. before any principal redemption. Denote by $B_C^{(A)}(m-1)$ the outstanding balance at the end of month $m-1$, after any principal redemption. This amount is carried forward and is, therefore, the current outstanding balance at the beginning of (and during) month m. To this amount, we add any shortfall from the previous month. The interest due to be paid is:

$$I_{\text{Due}}^{(A)}(m) = B_C^{(A)}(m-1)r^{(A)} + I_{SF}^{(A)}(m-1)(1+r^{(A)}), \tag{2.17}$$

where $I_{SF}^{(A)}(m-1)$ is any interest shortfall from month $m-1$ and $r^{(A)}$ is the (monthly) interest rate for the A notes. We assume the interest rate on shortfalls is the same as the note interest rate.

The *Class A Interest Paid* is the minimum of available funds after item 1 in the waterfall and the Class A Interest Due is:

$$I_P^{(A)}(m) = \min\left(I_{\text{Due}}^{(A)}(m), A_F^{(1)}(m)\right). \tag{2.18}$$

If there is not enough available funds to cover the interest payment, the shortfall

$$I_{SF}^{(A)}(m) = I_{\text{Due}}^{(A)}(m) - I_P^{(A)}(m), \tag{2.19}$$

is carried forward to the next month.

After the Class A interest payment has been made, we update available funds. If there is a shortfall, the available funds are zero, otherwise it is available funds from item 1 less Class A Interest Paid. The available funds are:

$$A_F^{(2)}(m) = \max\left(0, A_F^{(1)}(m) - I_P^{(A)}(m)\right). \tag{2.20}$$

(3) Class B Interest

The Class B interest payment is calculated in the same way as the Class A interest payment:

$$\begin{aligned}
I_{\text{Due}}^{(B)}(m) &= B_C^{(B)}(m-1)r^{(B)} + I_{SF}^{(B)}(m-1)(1+r^{(B)}),\\
I_P^{(B)}(m) &= \min\left(I_{\text{Due}}^{(B)}(m), A_F^{(2)}(m)\right),\\
I_{SF}^{(B)}(m) &= I_{\text{Due}}^{(B)}(m) - I_P^{(B)}(m),\\
A_F^{(3)}(m) &= \max\left(0, A_F^{(2)}(m) - I_P^{(B)}(m)\right).
\end{aligned} \tag{2.21}$$

(4) Class A Principal

The principal payment to the Class A Notes and the Class B Notes are based on the *note replenishment amount*. In our example, we assume that this amount is equal to the total principal reduction $P_{\text{Red}}(m)$ given in (2.12).

We are going to denote the proportion of the total principal reduction allocated to the A notes and the B notes $P_{\text{Red}}^{(A)}(m)$ and $P_{\text{Red}}^{(B)}(m)$, respectively. Note that:

$$P_{\text{Red}}(m) = P_{\text{Red}}^{(A)}(m) + P_{\text{Red}}^{(B)}(m). \tag{2.22}$$

If *pro rata* allocation is applied, the notes share the principal reduction in proportion to their fraction of the total initial outstanding principal amount.[1]

If we denote by $\alpha^{(A)}$, the proportion of the principal reduction $P_{\text{Red}}(m)$ that should be allocated to Class A, we have that:

$$\alpha^{(A)} = \frac{B_C^{(A)}(0)}{B_C^{(A)}(0) + B_C^{(B)}(0)}. \tag{2.23}$$

That is, if principal due is allocated pro rata we have:

$$P_{\text{Red}}^{(A)}(m) = \alpha^{(A)} P_{\text{Red}}(m). \tag{2.24}$$

In our example, $\alpha^{(A)} = 80\,\%$ of the available funds should be allocated to the Class A Notes. On the other hand, if we apply *sequential* allocation, we should first redeem the A notes until zero, before we redeem the B notes. In this case, the portion of the total principal reduction allocated to Class A is:

$$P_{\text{Red}}^{(A)}(m) = \min\left(P_{\text{Red}}(m),\, B_C^{(A)}(m-1) - P_{SF}^{(A)}(m-1)\right). \tag{2.25}$$

The Class A Principal Due is the minimum of the outstanding principal amount of the A notes and the sum of the Class A redemption amount and any Class A Principal Shortfall from the previous month, that is:

$$P_{\text{Due}}^{(A)}(m) = \min\left(B_C^{(A)}(m-1),\, P_{\text{Red}}^{(A)}(m) + P_{SF}^{(A)}(m-1)\right). \tag{2.26}$$

The *Class A Principal Paid* is the minimum of the available funds after item 3 and the Class A Principal Due is:

$$P_P^{(A)}(m) = \min\left(P_{\text{Due}}^{(A)}(m),\, A_F^{(3)}(m)\right). \tag{2.27}$$

The new current outstanding balance at the end of month m after the principal redemption is:

$$B_C^{(A)}(m) = B_C^{(A)}(m-1) - P_P^{(A)}(m), \tag{2.28}$$

and any eventual shortfall equals:

$$P_{SF}^{(A)}(m) = P_{\text{Due}}^{(A)}(m) - P_P^{(A)}(m). \tag{2.29}$$

The available funds after principal payment to Class A is zero or the difference between available funds after item 3 and Class A Principal Paid, whichever is greater:

[1] One could also calculate the proportion according to the notes fraction of the current outstanding principal amount. In this case the proportions might vary over time.

$$A_F^{(4)}(m) = \max\left(0, A_F^{(3)}(m) - P_P^{(A)}(m)\right). \tag{2.30}$$

(5) Class B Principal

If *pro rata* allocation is applied, the proportion of the total principal reduction that should be allocated to Class B is:

$$P_{\text{Red}}^{(B)}(m) = \alpha^{(B)} P_{\text{Red}}(m), \tag{2.31}$$

where

$$\alpha^{(B)} = 1 - \alpha^{(A)} = \frac{B_C^{(B)}(0)}{B_C^{(A)}(0) + B_C^{(B)}(0)}. \tag{2.32}$$

The Class B Principal Due under a *sequential* allocation scheme is zero, as long as the Class A Notes are not redeemed completely. After that, the Class B Principal Due is the minimum of the outstanding principal amount of the B notes and the sum of the principal reduction of the asset pool and any principal shortfall from previous month.

There are two cases to take into account:

1. If $P_{\text{Red}}^{(A)}(m) = P_{\text{Red}}(m)$, then $P_{\text{Red}}^{(B)}(m) = 0$.
2. If $P_{\text{Red}}^{(A)}(m) = B_C^{(A)}(m-1) - P_{SF}^{(A)}(m-1)$, then $P_{\text{Red}}^{(B)}(m) = P_{\text{Red}}(m) - P_{\text{Red}}^{(A)}(m)$.

The *Class B Principal Due* is:

$$P_{\text{Due}}^{(B)}(m) = \min\left(B_C^{(B)}(m-1), P_{\text{Red}}^{(B)}(m) + P_{SF}^{(B)}(m-1)\right). \tag{2.33}$$

The *Class B Principal Paid* is the minimum of the available funds after item 4 and the Class B Principal Due:

$$P_P^{(B)}(m) = \min\left(P_{\text{Due}}^{(B)}(m), A_F^{(4)}(m)\right). \tag{2.34}$$

The new current outstanding balance at the end of month m after the principal redemption is:

$$B_C^{(B)}(m) = B_C^{(B)}(m-1) - P_P^{(B)}(m), \tag{2.35}$$

and any eventual shortfall equals:

$$P_{SF}^{(B)}(m) = P_{\text{Due}}^{(B)}(m) - P_P^{(B)}(m). \tag{2.36}$$

The available funds after principal payment to Class B is:

$$A_F^{(5)}(m) = \max\left(0, A_F^{(4)}(m) - P_P^{(B)}(m)\right). \tag{2.37}$$

Note that if there is a shortfall, available funds equal zero.

(6) Reserve Account Reimbursement

The principal balance of the reserve account at the end of the month must be restored to the target amount. If enough available funds exist after the Class B principal payment, the reserve account is fully reimbursed, otherwise the balance of the reserve account is equal to the available funds after item 5, and a shortfall is carried forward.

The reimbursement is:

$$B^{(CR)}(m) = \max\left(B_{\text{Targ}}^{(CR)}(m), A_F^{(5)}(m)\right), \tag{2.38}$$

where the target balance on the reserve account is given as a fraction ($q_{\text{Targ}}^{(CR)}$) of the current outstanding pool balance:

$$B_{\text{Targ}}^{(CR)}(m) = B_C^{(P)}(m) q_{\text{Targ}}^{(CR)}. \tag{2.39}$$

After the reserve account reimbursement, the available funds are updated:

$$A_F^{(6)}(m) = \max\left(0, A_F^{(5)}(m) - B^{(CR)}(m)\right). \tag{2.40}$$

(7) Residual Payments

Whatever money that is left after item 6 is paid as a residual payment to the Class B note holders as an additional return.

Loss Allocation

In our example, which is a cash structure, losses are crystallized at maturity (T). The total losses of the Class A and B notes are $P_{SF}^{(A)}(m_T)$ and $P_{SF}^{(B)}(m_T)$, respectively.

Pari Passu

In the above waterfall, Class A Notes' interest payments are ranked senior to Class B Notes' interest payments. Assuming that the interest payments to Class A Notes and Class B Notes are paid *pari passu* instead, then Class A Notes and Class B Notes have equal right to the available funds after item 1, and items 2 and 3 in the waterfall effectively become one item. Similarly, we can also assume that Class A and Class B principals due are allocated pro rata and paid pari passu.

For example, assuming that the principal due in month m to Class A Notes and Class B Notes are allocated pari passu, then the principal paid to the two classes is:

$$P_P^{(A)}(m) = \min\left(P_{\mathrm{Due}}^{(A)}(m), \beta^{(A)} A_F^{(3)}(m)\right) \tag{2.41}$$

and

$$P_P^{(B)}(m) = \min\left(P_{\mathrm{Due}}^{(B)}(m), \beta^{(B)} A_F^{(3)}(m)\right), \tag{2.42}$$

where

$$\beta^{(A)} = \frac{P_{\mathrm{Due}}^{(A)}(m)}{P_{\mathrm{Due}}^{(A)}(m) + P_{\mathrm{Due}}^{(B)}(m)} \tag{2.43}$$

and $\beta^{(B)} = 1 - \beta^{(A)}$.

2.3.2 Deriving an Expected Loss Rating

To derive ratings to the notes in the above example, we could apply the methodology described in Sect. 1.4.2. We can express the Relative Net Present Value Loss (RPVL), the Expected Loss (EL), the Weighted Average Life (WAL), and the Expected Average Life (EAL) more explicit in terms of the quantities introduced for the two-note structure example in Sect. 2.3.1. The present value of the cashflows under the A note, for a given scenario s, is:

$$\mathrm{PVCF}_A(s) = \sum_{m=1}^{m_T} \frac{\left(I_P^{(A)}(m;s) + P_P^{(A)}(m;s)\right)}{(1 + r_A/12)^{m/12}}, \tag{2.44}$$

where $I_P^{(A)}(m;s)$ and $P_P^{(A)}(m;s)$ is the interest and principal payment received, respectively, in month m under scenario s (see Sect. 2.3.1). We have included s in the expressions to emphasize that these quantities depend on the given scenario.

Thus, for the A note the relative present value loss under scenario s is given by:

$$\mathrm{RPVL}_A(s) = \frac{B_0^{(A)} - PVCF_A(s)}{B_0^{(A)}}, \tag{2.45}$$

where $B_0^{(A)}$ is the initial nominal amount of the A tranche.

Remember that $B_C^{(A)}(m)$ is the outstanding amount at the end of month m. This amount is carried forward and is, therefore, the outstanding balance during month $m + 1$. The weighted average life $WAL_A(s)$ for the A notes (in years) is therefore:

$$\mathrm{WAL}_A(s) = \frac{1}{12 B_0^{(A)}} \left(\sum_{m=0}^{m_T - 1} B_C^{(A)}(m;s)\right). \tag{2.46}$$

Since we assume monthly payments, the factor $\frac{1}{12}$ is used to express WAL in years.

The weighted average life can also be expressed in terms of principal paid as follows[2]:

$$\mathrm{WAL}_A(s) = \frac{1}{12B_0^{(A)}}\left(\sum_{m=1}^{m_T} m P_P^{(A)}(m; s) + m_T B_C^{(A)}(m_T; s)\right), \tag{2.47}$$

where $B_C^{(A)}(m_T; s)$ is the current outstanding amount of the A notes at maturity (at the end of month m_T) after any amortisation. Thus, we assume that if the notes are not fully amortised after the legal maturity, any outstanding balance is amortised at maturity. Since we assume monthly payments, the factor $\frac{1}{12}$ is used to express WAL in years.

Reference

1. Moody's Investor Service : Contradictions in terms: variations in terminology in the mortgage market. International Structured Finance, Special Report, 9 June 2000

[2] Remember that $B_C^{(A)}(m) = B_C^{(A)}(m+1) + P_P^{(A)}(m+1), m = 0, 1, 2, \ldots m_T - 1$, see (2.28).

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