



## Public Works Loan Board

11 April 2018

# TECHNICAL NOTE

## CALCULATION OF INTEREST RATES ON PWLB AND NLF FIXED RATE LOANS AND PWLB VARIABLE RATE LOANS

Interest rates on PWLB<sup>1</sup> and NLF<sup>2</sup> fixed rate loans and PWLB variable rate loans are determined by the UK Debt Management Office (DMO) using a methodology specified by HM Treasury in accordance with section 5 of the National Loans Act 1968. The methodology is designed to ensure that the Government does not on-lend at rates lower than those at which it could notionally borrow, and generally to ensure compliance with the policies of HM Treasury.

This DMO technical note replaces the version of 03 August 2017.

### PWLB AND NLF FIXED RATE LOANS

PWLB and NLF Fixed rate loans are repayable by one of three methods:

- (i) **Maturity**: half-yearly payments of interest only, with a single repayment of principal at the end of the term.
- (ii) **EIP** (Equal Instalments of Principal): equal half-yearly instalments of principal together with interest on the balance outstanding at the time.
- (iii) **Annuity** or **ER** (Equal Repayments): fixed half-yearly payments to include principal and interest.

Repayments are at half-yearly intervals, with an initial broken period as necessary.

The rate of interest that applies to a loan depends on its maturity and the method of repayment (i.e. maturity, EIP or ER). Loan periods are divided into half year maturity intervals or bands, and the rate of interest is the same for all loans of a given method of repayment in a given band.

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<sup>1</sup> The Public Works Loan Board

<sup>2</sup> The National Loans Fund

For each of the three methods of repayment the rates are calculated in similar ways. First, for each method of repayment the maturity bands are converted into equivalent average life bands. The average life of a loan is calculated from the time to maturity of the loan using a time-weighted average of capital repayments (i.e. the interest payments are not included in the calculation). For maturity loans the average life is equal to the time to maturity of the loan, whilst for EIP and ER loans the average life is less than the time to maturity. The formulae used to calculate the average life appear in in the Annex to this note.

At each determination of rates the DMO uses current gilt prices to estimate a gilt par yield curve. For new loan rates the maximum par yield for each average life band is then calculated. Next, a margin is added. Currently this margin is the same for all maturities and is 100 basis points for PWLB Standard Rate loans, 80 basis points for PWLB Certainty Rate loans<sup>3</sup>, 60 basis points for Local Infrastructure Rate loans<sup>4</sup> and 11 basis points for NLF loans. Once the margin has been added, the resultant rate is rounded up to the nearest basis point to give the new loan rate for the band. For **early repayment rates** the minimum par yield for each average life band is calculated. Next, a margin is subtracted. For PWLB and NLF loans this margin is currently 11 basis points at all maturities. Once this margin has been subtracted, the resultant rate is rounded down to the nearest basis point to give the early repayment rate for the band. The DMO has provided guidance of how the formula is applied which can be found under the [Technical Help](#) section on the PWLB website.

Note: The yield curve model used by the DMO is the Variable Roughness Penalty (VRP) model developed by the Bank of England and employed by the DMO since 2007. For more information on the Bank of England yield curve models see:

<https://www.bankofengland.co.uk/-/media/boe/files/statistics/yield-curves/yield-curve-terminology-and-concepts>

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<sup>3</sup> The PWLB Certainty Rate is 20 basis points below the PWLB Standard Rate

<sup>4</sup> The PWLB Local Infrastructure Rate is 40 basis points below the PWLB Standard Rate

## PWLB VARIABLE RATE LOANS

PWLB Variable rate loans are repayable by one of two methods:

- (i) **Maturity:** monthly, quarterly or half-yearly payments of interest only with a single repayment of principal at the end of the term.
- (ii) **EIP** (Equal Instalments of Principal): equal monthly, quarterly or half-yearly instalments of principal together with interest on the balance outstanding at the time.

Repayments are at one, three or six monthly intervals.

Interest rates for variable rate loans are calculated for the time horizon that corresponds to the repayment frequency of the loan on the day concerned, adding a margin and then rounding the resultant rate up to the nearest basis point. The margin is the same for both types of variable rate loan and is 10 basis points for loans agreed before 12:30 on 20 October 2010 and is 100 basis points for Standard Rate loans agreed thereafter and 80 basis points for Certainty Rate loans.

**Early repayment rates** are taken from the set of rates for loans agreed before 12:30 on 20 October 2010. The DMO has provided guidance of how the formula is applied which can be found under the Technical Help section on the PWLB website.

## CHANGES TO CALCULATIONS

HM Treasury reserves the right to alter formulae, margins or other parameters used in the calculation of the rates for PWLB and NLF fixed rate loans and PWLB variable rate loans, exceptionally without notice.

## FURTHER ENQUIRIES

Questions on this note should be directed to the PWLB team at the UK Debt Management Office, telephone: 020 7862 6610 or e-mail: [pwlb@dmo.gov.uk](mailto:pwlb@dmo.gov.uk).

## APPENDIX A: FORMULAE FOR THE AVERAGE LIFE OF PWLB AND NLF FIXED RATE LOANS

The following formulae are used to calculate the average life of PWLB and NLF fixed rate loans.

(i) Maturity Loans:

Average life of the loan (years) = Time to maturity of the loan (years)

For example, the average life of a 50 year maturity loan would be 50 years.

(ii) EIP Loans:

Average life of the loan (years) =  $\left( \frac{\text{Time to maturity of the loan (years)}}{2} \right) + 0.25$

For example, the average life of a 50 year EIP loan would be 25.25 years.

(iii) Annuity or ER Loans:

Average life of the loan (years) =  $\frac{\text{Time to maturity of the loan (years)}}{1 - \frac{1}{\left(1 + \frac{Y}{200}\right)^{2 \times \text{Time to maturity (years)}}}} - \frac{100}{Y}$

where, Y is the par yield corresponding to the average life of the loan (expressed as a percentage).

Note: For ER loans the average life is dependent on the level of yields at the time at which rates are calculated and is derived using an iterative process.

For example, the average life of a 50 year ER loan would be 33.30 years, assuming that the 33.30 year par yield is 4.175%.

## APPENDIX B: CALCULATION OF INTEREST ON INITIAL BROKEN PERIOD

The interest due on an initial broken period is calculated on the basis of Actual/Actual. This is calculated as:–

$$\text{Interest} = \frac{\text{Amount of Loan} * \frac{1}{2} \text{ Yearly Interest Rate} * \text{Days (First Payment Date - Advance Date)}}{\text{Days (First Payment Date– Notional Previous Payment Date)}}$$

### Worked examples

1. £1 million loan advanced 15 October 2009 at a rate of 3%;  
repayments to be made 31 March, 30 September

$$\begin{aligned} \text{Interest} &= \frac{\text{Amount of Loan} * \frac{1}{2} \text{ Yearly Interest Rate} * \text{Days (First Payment Date - Advance Date)}}{\text{Days (First Payment Date– Notional Previous Payment Date)}} \\ &= \frac{1,000,000 * 0.015 * \text{Days (31 March 2010 – 15 October 2009)}}{\text{Days (31 March 2010 – 30 September 2009)}} \\ &= \frac{1,000,000 * 0.015 * 167}{182} = \text{£}13,763.74 \end{aligned}$$

2. £1 million loan advanced 16 April 2010 at a rate of 3%;  
repayments to be made 31 March, 30 September

$$\begin{aligned} \text{Interest} &= \frac{\text{Amount of Loan} * \frac{1}{2} \text{ Yearly Interest Rate} * \text{Days (First Payment Date - Advance Date)}}{\text{Days (First Payment Date– Notional Previous Payment Date)}} \\ &= \frac{1,000,000 * 0.015 * \text{Days (30 September 2010 - 16 April 2010)}}{\text{Days (30 September 2010 - 31 March 2010)}} \\ &= \frac{1,000,000 * 0.015 * 167}{183} = \text{£}13,688.52 \end{aligned}$$