Advisory

Subject: **Capital Requirements for Federally Regulated Mortgage Insurers**

Category: **Capital**

Date: **January 1, 2017**

I. Introduction

This Advisory sets out the regulatory capital adequacy requirements for federally regulated mortgage insurers and complements OSFI's Guideline A, Minimum Capital Test for Federally Regulated Property and Casualty Insurance Companies.

The requirements included in this Advisory are effective January 1, 2017.

II. Application of the Minimum Capital Test

Except as specified otherwise in this Advisory, mortgage insurers are subject to the capital adequacy requirements set out in the Minimum Capital Test (MCT) Guideline for federally regulated property and casualty insurance companies. The required adjustments to the MCT Guideline for the capital requirements for mortgage insurers are as follows.

- Section III *Transitional Arrangements* of this Advisory specifies the requirements for mortgage insurers to phase-in the capital impact of the new regulatory capital requirements.
- Section IV *Mortgage Insurance Risk* of this Advisory describes the capital requirements for mortgage insurance risk. This section replaces Chapter 4 *Insurance Risk* of the MCT Guideline.
- Section V *Mortgage Insurer Operational Risk* of this Advisory describes a mortgage insurer's capital requirements for operational risk. This section replaces Chapter 7 *Operational Risk* of the MCT Guideline.
- Chapter 8 *Diversification Credit* of the MCT Guideline does not apply to mortgage insurers.

III. Transitional Arrangements

1. Transitional arrangements for mortgage insurance risk

The capital required for premium liabilities associated with residential exposures is determined using the formula for required capital stated in section IV, subsection 1.1 in the following way.

The total of premium liabilities and capital, *T*, is equal to the sum of:

- the total of premium liabilities and capital for residential mortgages originated after December 31, 2016, determined in accordance with subsections 1.1.1 through 1.1.5,
- the total of premium liabilities and capital for residential mortgages originated on or before December 31, 2016 that were individually insured and had amortization at origination of 25 years or less, determined in accordance with subsections 1.1.1 through 1.1.5, and
- the total of premium liabilities and capital for residential mortgages originated on or before December 31, 2016 that were insured in bulk or that had amortization at origination greater than 25 years, determined as follows.

The total of premium liabilities and capital for residential mortgages originated on or before December 31, 2016 that were insured in bulk or that had amortization at origination greater than 25 years is equal to the smaller of:

- the total of premium liabilities and capital for such mortgages determined in accordance with subsections 1.1.1 through 1.1.5, and
- the total of premium liabilities and capital for such mortgages determined as of December 31, 2016 using the instructions referenced to prepare and file the requirements with OSFI as at that date (the previous framework), with the capital component calculated at the 220% MCT level and the liability component determined as follows.

For companies that used the unearned premium reserve schedule provided in the previous framework or their own unearned premium reserve schedule, the liability component is the sum of the liabilities for the individual mortgages. For companies that determined premium liabilities in bulk, the liability component is that portion of the bulk provision that can be attributed to the residential mortgages that were not individually insured and did not have amortization at origination of 25 years or less; in this case, the allocated portion of the bulk provision should be determined in accordance with actuarial and accounting standards but not be less than if the allocation were in proportion to outstanding balance.

Note that the amounts determined using the instructions in the previous framework are based on exposure information as of mortgage origination and may include amounts for mortgages that are no longer in-force as of the reporting date. Moreover, the amounts determined using the instructions in the previous framework are calculated once based on December 31, 2016 information and do not decline as these mortgages age or are paid down. Consequently, the total of premium liabilities and capital for residential mortgages originated on or before December 31, 2016 that were insured in bulk or that had amortization at origination greater than 25 years will

remain constant in dollar terms until such time that the total of premium liabilities and capital for these mortgages determined in accordance with subsections 1.1.1 through 1.1.5 is lower.

2. Determination of adjustment factors for credit quality

The new capital framework for mortgage insurance risk differentiates capital requirements according to borrower credit score, and will eventually take into consideration the age of the credit score as well, as described in subsection 1.1.4. However, as a temporary measure, the credit quality adjustment factor m defined in subsection 1.1.4 is to be determined as follows:

- If a mortgage insurer is able to obtain credit scores as of December 31, 2015 or later for at least 90% of the mortgage loans originated on or before December 31, 2015, then this credit score should be used to define the credit quality adjustment factor m with the corresponding m-values as in subsection 1.1.4 i) *Credit scores of individual mortgage loans updated annually*.
- If a mortgage insurer is unable to obtain credit scores as of December 31, 2015 or later for at least 90% of the mortgage loans originated on or before December 31, 2015 then the credit score as of mortgage origination should be used to define the credit quality adjustment factor m with the corresponding m-values as in subsection 1.1.4 iii) *No regular updating of credit scores or credit score migration characteristics*. In this case the age of the credit score should be determined as of December 31, 2016.
- For mortgage loans originated after December 31, 2015, the credit score as of mortgage origination should be used to define the credit quality adjustment factor m with the corresponding m-values as in subsection 1.1.4 i) *Credit scores of individual mortgage loans updated annually*.

3. Transitional arrangements for operational risk

Mortgage insurers are required to phase-in the impact that the mortgage insurance risk requirements of this Advisory have on their operational risk capital requirements. The phase-in should be done on a straight-line basis, over twelve quarters, starting with the first quarter of 2017.

The capital impact for mortgage insurers' operational risk to be phased-in is equal to the difference between capital required for operational risk under the previous framework and the capital required for operational risk under this Advisory (the new framework). In order to determine the phase-in amount, mortgage insurers are required to calculate two sets of operational risk capital requirements as at December 31, 2016. The operational risk requirements under the previous framework are the same as those prepared and filed with OSFI for regulatory compliance purposes. The capital requirements under the new framework as at December 31, 2016 do not need to be filed with OSFI.

For example, a mortgage insurer must file with OSFI its operational risk requirement under the previous framework as at December 31, 2016 and must calculate an amount for operational risk under the new framework as at the same date. The difference in capital required for operational risk is the capital impact to be amortized evenly over the next twelve quarters. The amortization of capital required for operational risk must be reported each quarter until December 31, 2019.

The phase-in amount is a one-time impact based on December 31, 2016 that will uniformly unwind to zero over the next twelve quarters. The phased-in capital required for operational risk is then determined using the following formula:

Phased-in Capital Required for operational risk = Capital Required for operational risk under this Advisory - n*/12 x (Capital Required for operational risk under this Advisory at December 31, 2016 – Capital Required for operational risk as filed with OSFI for regulatory compliance purposes as at December 31, 2016)*

Where *n* declines from 11 in the first quarter 2017 to 0 in the fourth quarter 2019.

IV. Mortgage Insurance Risk

Mortgage insurance risk is the risk that the provisions that a mortgage insurer holds to cover its obligations under the mortgage insurance contracts it has written are insufficient under a severe but plausible scenario.

The capital requirement for mortgage insurance risk consists of:

i. a capital requirement for future losses, i.e., losses associated with defaults that occur after the reporting date, referred to as the capital required for premium liabilities;

ii. a capital requirement for losses that have already occurred and for which settlement is not yet complete, referred to as the capital required for unpaid claims; and,

iii. a capital requirement for the possible inadequacy of any provisions for premium deficiencies.

For the purposes of this Advisory, a residential mortgage is a mortgage on a property that is designed for occupancy by not more than four family units or is a single-family unit of a condominium. A mortgage that is not considered to be a residential mortgage according to this definition will be referred to as a commercial mortgage.

Section 1 describes the calculation of the capital requirement for residential exposures while section 2 describes the calculation for commercial exposures. Section 3 describes the calculation of the additional policy provision. For residential exposures, the additional policy provision is an allocation of the requirement determined in section 1; for commercial exposures, it is an amount that is held in addition to the requirement determined in section 2.

1. Residential exposures

1.1. Capital required for premium liabilities

Premium liabilities are the liabilities that a mortgage insurer holds to cover future losses, i.e., losses associated with defaults that occur after the reporting date.

The capital required for premium liabilities associated with residential exposures is defined as

$$\max(T - L, F)$$

where:

- T represents the total of premium liabilities and capital for residential exposures and is defined in subsections 1.1.1 through 1.1.3,
- L is the amount of premium liabilities that the mortgage insurer actually holds for residential exposures and is defined by accounting standards[1], and
- F represents a floor on the capital requirements for residential exposures and is currently set at 0.

1.1.1. Total requirement

The total amount T required for residential exposures is the sum of the total amounts required for individual residential mortgages, whether insured individually or as part of a portfolio, that are in-force as of the reporting date and for which there is no claim outstanding[2]. The total amount required for an individual mortgage loan is the sum of the base total requirement for the mortgage loan and, if applicable, a supplementary capital requirement.

The formula for calculating the base total requirement for an individual mortgage loan is provided in subsection 1.1.2. The formula for calculating the supplementary capital requirement is provided in subsection 1.1.3. The following data inputs are used in the calculation of the base total requirement and the supplementary capital requirement for an individual mortgage loan:

i. outstanding loan balance as of the reporting date;
ii. remaining amortization for the mortgage loan as of the reporting date;
iii. credit score of the borrower(s) determined as described in section 1.1.4; and
iv. property value, determined as described in subsection 1.1.5.

1.1.2. Base total requirement for an individual mortgage loan

The base total requirement for an individual mortgage loan that is in-force on the reporting date and for which there is no claim outstanding is determined by the formula

$$T_B = \alpha_B + \beta_B \times outstanding\ loan\ balance$$

where the outstanding loan balance is the loan balance as of the reporting date in units of $100,000 and

$$\alpha_B = m \times A$$

$$\beta_B = m \times B$$

[1] For the purposes of this calculation, L includes liability amounts for incurred but not reported (IBNR) claims.
[2] Mortgages that are in arrears or default are excluded from this calculation provided that a specific provision for such mortgages is included in the unpaid claim reserve; otherwise, they should be included.

where m is the adjustment factor for credit quality defined in subsection 1.1.4, and where the quantities A and B are defined as follows.

i) Formula for A

$$A = \left\{ C_1 \times \exp\left(\frac{-\left(\frac{1}{LTV} - \mu_1\right)^2}{2 \cdot {\sigma_1}^2} \right) + C_2 \times \exp\left(\frac{-\left(\frac{1}{LTV} - \mu_2\right)^2}{2 \cdot {\sigma_2}^2} \right) \right\}$$

where LTV represents the loan-to-value ratio[3] for the mortgage loan as defined in subsection 1.1.5 and $\mu_1, \mu_2, \sigma_1, \sigma_2, C_1, C_2$ are defined as follows:

If the remaining term of insurance for the mortgage loan as of the reporting date is five years or less then

$$\mu_1 = 90\% \quad for\ T^* \le 40 \qquad \mu_2 = 125\% \quad for\ T^* \le 40$$

$$\sigma_1 = \begin{cases} 17\% & for\ T^* \le 10 \\ -0.2\% \times T^* + 19\% & for\ 10 < T^* \le 25 \\ 14\% & for\ 25 < T^* \le 40 \end{cases} \qquad \sigma_2 = \begin{cases} 16\% & for\ T^* \le 15.5 \\ 0.59\% \times T^* + 7\% & for\ 15.5 < T^* \le 40 \end{cases}$$

$$C_1 = \begin{cases} 123 \times T^* + 520 & for\ T^* \le 11 \\ -25 \times T^* + 2{,}250 & for\ 11 < T^* \le 40 \end{cases} \qquad C_2 = \begin{cases} 115 \times T^* - 85 & for\ T^* \le 17 \\ 1{,}900 & for\ 17 < T^* \le 40 \end{cases}$$

where T^* represents the remaining amortization for the mortgage loan as of the reporting date and is measured in years[4].

Otherwise,

$$\mu_1 = 90\% \qquad \mu_2 = 125\%$$

$$\sigma_1 = 17\% \qquad \sigma_2 = \begin{cases} 16\% & for\ T^* \le 15.5 \\ 1.09\% \times T^* - 0.94\% & for\ T^* > 15.5 \end{cases}$$

$$C_1 = \begin{cases} 123 \times T^* + 520 & for\ T^* \le 16 \\ -65 \times T^* + 3{,}515 & for\ 16 < T^* \le 25 \\ -39 \times T^* + 2{,}885 & for\ T^* > 25 \end{cases} \qquad C_2 = \begin{cases} 115 \times T^* - 85 & for\ T^* \le 25 \\ 68 \times T^* + 1{,}110 & for\ T^* > 25 \end{cases}$$

[3] Throughout this Advisory, the loan-to-value ratio used for a residential exposure is a hybrid ratio in the sense that the loan balance in the ratio is the outstanding loan balance on the reporting date while the property value in the ratio is the property value on some earlier fixed date, possibly with adjustments. Details of the calculation are provided in subsection 1.1.5. The loan-to-value ratio used for commercial exposures is described in the section on commercial exposures.

[4] If a mortgage is split into tranches, then the remaining amortization used in this and subsequent formulas is the maximum of the remaining amortizations of all tranches.

ii) Formula for B

$$B = \left\{ C_1 \times \exp\left(\frac{-\left(\frac{1}{LTV} - \mu_1\right)^2}{2 \cdot {\sigma_1}^2} \right) + C_2 \times \exp\left(\frac{-\left(\frac{1}{LTV} - \mu_2\right)^2}{2 \cdot {\sigma_2}^2} \right) \right\}$$

where LTV represents the loan-to-value ratio for the mortgage loan as defined in subsection 1.1.5 and in this case, μ_1, μ_2, σ_1, σ_2, C_1, C_2 are defined as follows:

If the remaining term of insurance for the mortgage loan as of the reporting date is five years or less then

$$\mu_1 = 94\% \quad for\ T^* \leq 40$$

$$\mu_2 = \begin{cases} 0.62\% \times T^* + 121\% & for\ T^* \leq 15 \\ 130\% & for\ 15 < T^* \leq 40 \end{cases}$$

$$\sigma_1 = \begin{cases} 23\% & for\ T^* \leq 14 \\ -0.64\% \times T^* + 32\% & for\ 14 < T^* \leq 25 \\ 16\% & for\ 25 < T^* \leq 40 \end{cases}$$

$$\sigma_2 = \begin{cases} 14\% & for\ T^* \leq 15 \\ 0.4\% \times T^* + 8\% & for\ 15 < T^* \leq 40 \end{cases}$$

$$C_1 = \begin{cases} 233 \times T^* + 1{,}975 & for\ T^* \leq 11 \\ 4{,}450 & for\ 11 < T^* \leq 40 \end{cases}$$

$$C_2 = \begin{cases} 1{,}550 & for\ T^* \leq 15 \\ 400 \times T^* - 4{,}450 & for\ 15 < T^* \leq 18 \\ 130 \times T^* + 420 & for\ 18 < T^* \leq 25 \\ 30 \times T^* + 3{,}020 & for\ 25 < T^* \leq 40 \end{cases}$$

where T^* represents remaining amortization for the mortgage loan as of the reporting date and is measured in years.

Otherwise,

$$\mu_1 = \begin{cases} 94\% & T^* \leq 19.75 \\ -2.33\% \times T^* + 140\% & 19.75 < T^* \leq 26 \\ 80\% & T^* > 26 \end{cases}$$

$$\mu_2 = \begin{cases} 0.62\% \times T^* + 121\% & for\ T^* \leq 33.25 \\ 142\% & for\ T^* > 33.25 \end{cases}$$

$$\sigma_1 = \begin{cases} 23\% & for\ T^* \leq 14.75 \\ 1.63\% \times T^* - 0.82\% & for\ T^* > 14.75 \end{cases}$$

$$\sigma_2 = \begin{cases} 14\% & for\ T^* \leq 19 \\ 1.03\% \times T^* - 5.84\% & for\ 19 < T^* \leq 27 \\ 21.5\% & for\ T^* > 27 \end{cases}$$

$$C_1 = \begin{cases} 233 \times T^* + 1{,}975 & for\ T^* \leq 25 \\ 282 \times T^* + 740 & for\ T^* > 25 \end{cases}$$

$$C_2 = \begin{cases} 1{,}550 & for\ T^* \leq 19.25 \\ 133 \times T^* - 1{,}030 & for\ 19.25 < T^* \leq 26 \\ -117 \times T^* + 5{,}490 & for\ T^* > 26 \end{cases}$$

1.1.3. Supplementary capital requirement for an individual mortgage loan

If a mortgage loan originated after December 31, 2016 corresponds to a property that is located in one of the 11 metropolitan areas listed in Appendix A and if the value of the supplementary capital requirement indicator (SCRI) for this metropolitan area is greater than the threshold value for this metropolitan area then a supplementary capital requirement must be determined for this mortgage loan and added to the base total requirement for this mortgage loan to determine the total amount for this loan.

The calculation of the SCRI is described in Appendix A.

If a supplementary capital requirement must be determined for a particular mortgage loan, it is calculated using the following formula:

$$S = r \times T_B$$

where T_B is as defined in subsection 1.1.2 and where the quantity r is defined as follows.

$$r = a + b \times \exp(-0.1 \cdot T^*)$$

where a and b are defined as follows:

If the remaining term of insurance for the mortgage loan as of the reporting date is five years or less then

$$a = min\left\{c + 0.1 \times \left(\frac{1}{LTV} - 1\right), 1.15\right\},$$

$$b = \begin{cases} 0.3 & for\ T^* \leq 10 \\ 0 & for\ T^* > 10 \end{cases}$$

$$c = \begin{cases} 0.08 & for\ T^* \leq 10 \\ -0.013 \times T^* + 0.32 & for\ 10 < T^* \leq 13 \\ 0.19 & for\ T^* > 13 \end{cases}$$

where:

- LTV represents the loan-to-value ratio for the mortgage loan as defined in subsection 1.1.5, and
- T^* represents remaining amortization as of the reporting date and is measured in years.

Otherwise,

$$a = min\left\{0.08 + 0.1 \times \left(\frac{1}{LTV} - 1\right), 1.15\right\},$$

$$b = 0.3$$

Note that for a given mortgage loan, LTV and T^* have the same values as in the calculation of the base total requirement in subsection 1.1.2.

1.1.4. Adjustment factor for credit quality of an individual mortgage loan

The adjustment factor for credit quality, m, used in the formulas for α_B and β_B to determine the base total requirement for an individual mortgage loan depends on

- the most recent credit score for the mortgage loan,
- the age of that credit score, and
- if applicable, the probability of the credit score migrating from one credit score range to another over time.

The credit score used to determine the value of m for a particular mortgage loan should come from a reputable credit bureau and should also be used as part of the mortgage insurer's business and risk management processes. It should not be acquired for the sole purpose of determining regulatory capital requirements.

In cases where a mortgage insurer obtains credit scores from more than one credit bureau, the mortgage insurer should select the bureau whose scores the mortgage insurer primarily uses in the management of its business, and use the scores of this credit bureau consistently for all mortgage loans and from one reporting period to the next. The only exception is if there is no credit score available for a particular mortgage loan from the credit bureau whose scores the mortgage insurer primarily uses to manage its business; in this situation, the mortgage insurer may use the credit score from another reputable credit bureau until such time that a credit score becomes available from the bureau whose scores the mortgage insurer primarily uses.

For mortgage loans with more than one borrower, the credit score used to determine the value of m is the maximum of the credit scores of the individual borrowers. In cases where the credit scores of the individual borrowers are from different credit bureaus, the maximum is calculated using only the credit scores from the bureau whose scores the mortgage insurer primarily uses to manage its business. In cases where none of the credit scores of the individual borrowers is from the credit bureau whose scores the mortgage insurer primarily uses to manage its business, the maximum is calculated using the available scores.

The age of the credit score used to determine the value of m for a particular mortgage loan is the time in years that has elapsed from the date that the credit score was obtained to the reporting date. For mortgage loans with more than one borrower, the age of the credit score used to determine the value of m is the age of the credit score that corresponds to the maximum credit score determined in the preceding paragraph.

The value assigned to the adjustment factor for credit quality, m, for an individual mortgage loan depends on the frequency with which the mortgage insurer updates the credit scores on its portfolio of residential exposures and the extent to which it has credible information on the migration of credit scores from one credit score range to another over time.

i) Credit scores of individual mortgage loans updated annually

If 90% or more of a mortgage insurer's mortgage loans that are considered residential exposures have a credit score that is no more than one year old then the value assigned to the adjustment factor for credit quality, m, for an individual mortgage loan is given by the following table:

Most Recent Credit Score	m
< 600	3.00
[600,620)	2.05
[620,640)	1.80
[640,660)	1.60
[660,680)	1.35
[680,700)	1.10
[700,720)	0.90
[720,740)	0.65
[740,760)	0.55
[760,780)	0.45
≥ 780	0.40

The value assigned to the adjustment factor for credit quality, m, of a mortgage loan with no credit score is 1.3 unless more than 5% of a mortgage insurer's mortgage loans considered residential exposures have no credit score, in which case the value assigned to the adjustment factor for credit quality, m, of a mortgage loan with no credit score is 3.0.

ii) Migration characteristics of credit scores determined annually

If less than 90% of a mortgage insurer's mortgage loans that are considered residential exposures have a credit score that is at most one year old and if the mortgage insurer has credible information on the probabilities of migrating from one credit score range to another over time then the value assigned to the adjustment factor for credit quality, m, for a particular mortgage loan is determined based on the calendar year of the most recent credit score for the mortgage loan in the following way.

Assume that credit scores are segmented into 11 bands as indicated in the following table:

Segment	Credit Score Band
1	< 600
2	[600,620)
3	[620,640)
4	[640,660)
5	[660,680)
6	[680,700)

Segment	Credit Score Band
7	[700,720)
8	[720,740)
9	[740,760)
10	[760,780)
11	≥ 780

Let $p_{i\to j}$ denote the probability that a mortgage loan in segment i at the beginning of a calendar year moves to segment j by the end of the year. In general, the probabilities $p_{i\to j}$ will change from one calendar year to the next to reflect changes in the mortgage insurer's book of business and the overall credit environment. Let $\boldsymbol{P_y}$ denote the matrix of probabilities $p_{i\to j}$ for calendar year y and write $\boldsymbol{P_y}$ as follows:

$$\boldsymbol{P_y} = \begin{pmatrix} p_{1\to 1} & p_{1\to 2} & \cdots & p_{1\to 11} \\ p_{2\to 1} & p_{2\to 2} & \ddots & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ p_{11\to 1} & \cdots & \cdots & p_{11\to 11} \end{pmatrix}$$

Note that $\boldsymbol{P_y}$ is an 11×11 matrix since there are 11 credit score bands; moreover, the sum of each row of $\boldsymbol{P_y}$ equals one since the $p_{i\to j}$ represent probabilities.

Now consider the collection of mortgage loans whose most recent credit score was obtained in calendar year y^* and suppose that the calendar year of the reporting period is $y^* + n$. Let $\vec{\boldsymbol{m}}_{\boldsymbol{y^*}}$ denote the vector of m values by credit score band for this collection of mortgage loans and write $\vec{\boldsymbol{m}}_{\boldsymbol{y^*}}$ as follows:

$$\vec{\boldsymbol{m}}_{\boldsymbol{y^*}} = \begin{pmatrix} m_1^{(y^*)} \\ \vdots \\ \vdots \\ m_{11}^{(y^*)} \end{pmatrix}$$

Note that, with this representation, $m_i^{(y^*)}$ is the m value for segment i. Then the vector $\vec{\boldsymbol{m}}_{\boldsymbol{y^*}}$ is determined from the following matrix equation:

$$\vec{\boldsymbol{m}}_{\boldsymbol{y^*}} = \boldsymbol{P_{y^*+n-1}} \cdot \boldsymbol{P_{y^*+n-2}} \cdots \boldsymbol{P_{y^*+1}} \cdot \vec{\boldsymbol{m}}$$

where $\vec{\boldsymbol{m}}$ is the vector of m values for the collection of mortgage loans whose most recent credit score is no more than one year old, in particular,

$$\vec{\boldsymbol{m}} = \begin{pmatrix} m_1 \\ \vdots \\ \vdots \\ m_{11} \end{pmatrix}$$

where the m_i are as given in the following table:

i	m_i
1	3.00
2	2.05
3	1.80
4	1.60
5	1.35
6	1.10
7	0.90
8	0.65
9	0.55
10	0.45
11	0.40

The components of the matrices $\boldsymbol{P_y}$ for the various calendar years y must be determined in a statistically sound manner and have values that are statistically credible. In particular, the probabilities $p_{i\to j}$ for calendar year y should be determined by selecting a random sample of mortgage loans with credit score in segment i at the beginning of calendar year y and considering the distribution of these mortgage loans by credit score segment at the end of the calendar year. The random samples should be of sufficient size to produce estimates of $p_{i\to j}$ that are reasonably credible.

The stability of the estimates should be tested by repeating the sampling procedure several times and comparing results. For segments where the estimates are not reasonably stable, e.g., due to a paucity of mortgage loans in a particular credit score band, the values of the probabilities $p_{i\to j}$ should be selected in a conservative manner; this generally means increasing the probability that a mortgage loan moves to a lower credit score band and decreasing the probability that it moves to a higher band or remains in its existing band.

If it is not possible to obtain stable estimates for at least 75% of the probabilities $p_{i\to j}$ then the m values for mortgage loans cannot be assigned using a credit score migration approach and one of the other methods for assigning m values must be used.

For a mortgage loan with no credit score, the value assigned to the adjustment factor for credit quality, m, is 1.3 unless more than 5% of a mortgage insurer's mortgage loans considered residential exposures have no credit score, in which case the value assigned to the adjustment factor for credit quality, m, is 3.0.

iii) No regular updating of credit scores or credit score migration characteristics

If less than 90% of a mortgage insurer's mortgage loans that are considered residential exposures have a credit score that is at most one year old and there is insufficient information on the probabilities of migrating from one credit score range to another by calendar year then the adjustment factor for credit quality, m, for a particular mortgage loan is given by the following table:

Most Recent Credit Score	Age of Credit Score					
	≤ 1 year	(1,2] years	(2,3] years	(3,4] years	(4,5] years	> 5 years
< 600	3.00	3.00	3.00	3.00	3.00	3.00
[600,620)	2.05	2.05	2.05	2.05	2.05	2.05
[620,640)	1.80	1.80	1.80	1.80	1.80	1.80
[640,660)	1.60	1.60	1.60	1.60	1.60	1.60
[660,680)	1.35	1.35	1.35	1.35	1.35	1.35
[680,700)	1.10	1.10	1.10	1.10	1.10	1.10
[700,720)	0.90	1.00	1.00	1.00	1.00	1.00
[720,740)	0.65	0.90	1.00	1.00	1.00	1.00
[740,760)	0.55	0.65	0.90	1.00	1.00	1.00
[760,780)	0.45	0.55	0.65	0.90	1.00	1.00
≥ 780	0.40	0.45	0.55	0.65	0.90	1.00

The value assigned to the adjustment factor for credit quality, m, of a mortgage loan with no credit score is 1.3 unless more than 5% of a mortgage insurer's mortgage loans considered residential exposures have no credit score, in which case the value assigned to the credit quality adjustment factor m of a mortgage loan with no credit score is 3.0.

1.1.5. Loan-to-value ratio for an individual mortgage loan

This subsection describes the calculation of the *LTV* input for the formulas given in subsections 1.1.2 and 1.1.3. Note that if the value of *LTV* determined in this subsection is greater than 100% then an *LTV* input of 100% should be used in the formulas in subsections 1.1.2 and 1.1.3.

The value of the *LTV* input for the formulas in subsections 1.1.2 and 1.1.3 depends on the origination date of the mortgage.

i) Mortgages originated after December 31, 2015

For mortgages originated after December 31, 2015, the *LTV* input is calculated by dividing the outstanding loan balance on the reporting date by the property value on the origination date or the date of the most recent appraisal, provided that the appraisal was commissioned by an independent third party entity other than a mortgage insurer.

ii) Mortgages originated after December 31, 2004 but on or before December 31, 2015

For mortgages originated after December 31, 2004 but on or before December 31, 2015, the LTV input is calculated by dividing the outstanding loan balance on the reporting date by the property value that is determined as follows.

1. If the property is located in one of the 11 Census Metropolitan Areas specified in Appendix A and defined by Statistics Canada then the property value used to calculate the LTV input is

$$Property\ Value\ at\ Origination\ \times \frac{Teranet\ index\ value\ as\ of\ December\ 2015}{Teranet\ index\ value\ as\ of\ origination\ month\ and\ year}$$

   where "Teranet index value" refers to the value of the Teranet-National Bank House Price Index for the particular metropolitan area as of the end of the indicated month. If the property is located in one of these metropolitan areas but the mortgage was originated in December 2015 or later then the property value used to calculate the LTV input is the property value on the origination date.

2. If the property is not located in one of these metropolitan areas then the property value used to calculate the LTV input is

$$Property\ Value\ at\ Origination \times \frac{Teranet\ composite\ index\ value\ as\ of\ December\ 2015}{Teranet\ composite\ index\ value\ as\ of\ origination\ month\ and\ year}$$

   where "Teranet composite index value" refers to the value of the Teranet-National Bank National Composite House Price Index as of the end of the indicated month.

iii) Mortgages originated prior to 2005

For mortgages originated prior to 2005, the LTV input is calculated by dividing the outstanding loan balance on the reporting date by the property value that is determined as follows.

1. If the property is located in one of the 11 Census Metropolitan Areas specified in Appendix A and defined by Statistics Canada then the property value used to calculate the LTV input is

$$Property\ Value\ at\ Origination\ \times \frac{Teranet\ index\ value\ as\ of\ December\ 2015}{Teranet\ index\ value\ as\ of\ December\ 2004}$$

   where "Teranet index value" refers to the value of the Teranet-National Bank House Price Index for the particular metropolitan area as of the end of the indicated month.

2. If the property is not located in one of these metropolitan areas then the property value used to calculate the LTV input is

$$Property\ Value\ at\ Origination\ \times \frac{Teranet\ composite\ index\ value\ as\ of\ December\ 2015}{Teranet\ composite\ index\ value\ as\ of\ December\ 2004}$$

where "Teranet composite index value" refers to the value of the Teranet-National Bank National Composite House Price Index as of the end of the indicated month.

1.2. Capital required for unpaid claims

Claim liabilities are the liabilities that a mortgage insurer holds to cover losses that have already occurred and for which settlement is not yet complete. This includes mortgage loans that are currently delinquent or in arrears. The capital required for unpaid claims associated with residential exposures is calculated by multiplying the claim liabilities associated with residential exposures by 20%.

1.3. Capital required for premium deficiencies

The capital required for premium deficiencies associated with residential exposures is calculated by multiplying the provision for premium deficiencies associated with residential exposures by 10%.

2. Commercial exposures

2.1. Capital required for premium liabilities

The capital required for premium liabilities associated with commercial exposures is the sum of the capital requirements for individual commercial exposures, where the sum is calculated over all commercial mortgage loans that were expected to be in-force on the reporting date based on the mortgage's amortization schedule at the time of mortgage origination. Unlike the situation for residential exposures, an amount must be calculated and held for all commercial mortgages that were expected to be in-force on the reporting date based on the mortgage's original amortization schedule, regardless of whether the mortgage is still in-force on the reporting date.

The capital required for an individual mortgage loan is determined by the formula

$$F_1 \times F_2 \times F_3 \times A$$

where:

- F_1 is a factor that depends on the age of the loan and is defined in subsection 2.1.1,
- F_2 is a factor that depends on whether the mortgage's loan-to-value ratio at origination is greater or less than 80% and whether the underlying mortgage is a first or second mortgage and is defined in subsection 2.1.2,
- F_3 is a factor that depends on the settlement option stated in the master policy and the mortgage's loan-to-value ratio at origination and is defined in subsection 2.1.3, and

- A is the mortgage balance, including any mortgage insurance premium amounts added to the balance, as of origination, measured in units of $100.[5]

2.1.1. Calculation of F_1

The value of F_1 for an individual mortgage loan depends on the number of years that have elapsed since the mortgage loan was issued and is defined by the following table.

Mortgage loan age (years)	Value of F_1
0	1.3750
1	1.3750
2	1.3375
3	1.2250
4	1.0875
5	0.9125
6	0.6750
7	0.4125
8	0.1250
≥ 9	0

The values for fractional ages can be determined by interpolation.

2.1.2. Calculation of F_2

The value of F_2 for an individual mortgage loan depends on whether the mortgage's loan-to-value ratio at origination is greater or less than 80% and whether the underlying mortgage is a first or second mortgage, and is defined by the following table.

	Priority	
Loan-to-Value Ratio at Origination	First Mortgage	Second Mortgage
≤ 80%	1.00	1.50
> 80%	1.50	1.50

2.1.3. Calculation of F_3

The value of F_3 for an individual mortgage loan depends on the settlement option stated in the master policy and the mortgage's loan-to-value ratio at origination.

[5] For second mortgages, A is the total amount of outstanding loan balance for both the first and second mortgage as of the date of loan issue.

If the maximum amount payable on an individual mortgage loan after all recoveries is 100% or more of the mortgage balance at origination then the value of F_3 is as defined in the following table.

Loan-to-Value Ratio at Origination	Value of F_3
≤ 50%	100%
50% < LTV ≤ 65%	100%
65% < LTV ≤ 75%	100%
75% < LTV ≤ 80%	105%
80% < LTV ≤ 85%	110%
85% < LTV ≤ 90%	115%
90% < LTV ≤ 95%	140%
LTV > 95%	150%

If the maximum amount payable on an individual mortgage loan after all recoveries is less than 100% of the mortgage balance at origination then the value of F_3 is as defined in the following table.

Maximum Amount Payable (% of Balance at Origination)	Value of F_3
10%	73%
15%	80%
20%	84%
25%	100%

If the amount payable on an individual mortgage loan is a fixed percentage of the lender's loss net of recoveries then the value of F_3 is determined by multiplying this fixed percentage by the value of F_3 in the case where the maximum amount payable is 100% of the mortgage balance at origination. For example, if the master policy provides coverage for 50% of the lender's loss net of recoveries and the loan-to-value ratio at origination is 85% then the value of F_3 would be 55% (= 50% × 110%).

2.2. Capital required for unpaid claims

The capital required for unpaid claims associated with commercial exposures is calculated by multiplying the claim liabilities associated with commercial exposures by 20%.

2.3. Capital required for premium deficiencies

The capital required for premium deficiencies associated with commercial exposures is calculated by multiplying the provision for premium deficiencies associated with commercial exposures by 10%.

3. Additional policy provisions

This section describes the calculation of the additional policy provision for residential and commercial exposures.

An additional policy provision must be determined for every mortgage that was expected to be in-force on the reporting date based on the mortgage's original amortization schedule, regardless of whether the mortgage is still in-force on the reporting date.

When calculating the MCT ratio, the total of the additional policy provisions for residential mortgages is to be deducted from the capital required for premium liabilities that is determined in section 1.1 and then added to the capital required for catastrophes, and the total of the additional policy provisions for commercial exposures is to be multiplied by 1.25 and simply added to the capital required for catastrophes.

The additional policy provision for an individual mortgage loan is given by the following table.

	Additional Policy Reserve as Per Cent of Single Premium Original Term of the Policy			
Completed Policy Duration in Years	**Up to 5 yrs**	**Over 5 to 10 yrs**	**Over 10 to 15 yrs**	**Over 15 to 40 yrs**
1	2.0	3.0	4.0	4.0
2	1.0	2.0	4.0	4.0
3	0.5	1.0	3.5	4.0
4		1.0	3.0	5.5
5		0.5	3.0	6.0
6		0.5	2.0	5.0
7		0.0	1.0	3.5
8			1.0	2.0
9			1.0	1.5
10			1.0	1.5
11			0.0	1.0
12				1.0
13				0.5
14				0.5
15				0.5
16				0.5
17				0.5
18				0.5
19				0.5
≥ 20				0.0

V. Mortgage Insurer Operational Risk

Operational risk is the risk of loss due to inadequate or failed internal processes, people and systems, or external events. It includes legal risk but does not include strategic or reputational risk.

The capital required for a mortgage insurer's operational risk is calculated using the following formula:

$$\textit{Operational risk capital required} = 20\% \times [TC - SC]$$

where:

TC is the mortgage insurer's total capital required, before the calculation of the requirement for operational risk.

SC is, if applicable, the supplementary capital required for mortgage insurance risk (reference subsection 1.1.3).

Appendix A. Determining supplementary capital requirement indicators

This appendix describes how mortgage insurers are to calculate the supplementary capital requirement indicators (SCRIs) for the purpose of determining whether a supplementary capital requirement is applied to a given residential mortgage loan.

The data sources necessary to calculate the SCRIs are outlined in Section 1 of this appendix. The Teranet – National Bank National Composite House Price Index ("Teranet index")[6] is used to measure house prices and Statistics Canada household disposable income and population data are used to measure per capita income.

An SCRI is to be determined for 11 metropolitan areas in the Teranet index. For each metropolitan area, an SCRI is calculated on a quarterly basis and is determined as follows:

$$\frac{H}{I} \times s$$

where:

- H is the smoothed value of the Teranet index for a metropolitan area as determined in Section 2;
- I is the per capita income value as determined in Section 3; and
- s is the scaling factor for the particular metropolitan area as indicated in Section 4.

OSFI will review the use of the 11 metropolitan areas and may decide to expand the calculation of SCRIs outside of these 11 metropolitan areas in the future.

The SCRI for a metropolitan area is compared to a threshold value for that particular area as defined in Section 5. If the SCRI exceeds the threshold value for that metropolitan area, then supplementary capital requirements will apply at the beginning of a mortgage insurer's next quarterly fiscal reporting period, according to the schedule presented in Section 6, for the life of the loan for newly originated mortgages in that metropolitan area[7].

An example illustrating how to calculate SCRIs is provided in Section 7.

1. Data sources

Mortgage insurers need to access the following data sources to calculate the SCRIs:

I. Teranet index data source: Teranet index, monthly (June 2005 = 100, Monthly to present)

II. Per capita income data sources:

   i. Statistics Canada Current and Capital Accounts – Households, quarterly – CANSIM table 380-0072

[6] In the future, OSFI may consider using equivalent house price indices with the same geographic coverage.

[7] The metropolitan areas geographical limits are determined using Statistics Canada definition of Census Metropolitan Areas.

ii. Statistics Canada Labour force survey estimates (LFS) by sex and age group, monthly, seasonally adjusted – CANSIM table 282-0087

The SCRIs are to be determined using as of dates of March 31, June 30, September 30 and December 31. As the income data in CANSIM table 380-0072 is the last item to be released, approximately two months after the calendar quarter ends, its release date determines when the SCRIs can be calculated.

2. Metropolitan area house price indices

The Teranet index values are available on a monthly basis for the following 11 metropolitan areas:

Calgary	Edmonton	Halifax
Hamilton	Montréal	Ottawa-Gatineau
Québec	Toronto	Vancouver
Victoria	Winnipeg	

The Teranet indices for the metropolitan areas as published are not seasonally adjusted. Given the seasonal nature of the housing market, the indices need to be smoothed to ensure the stability of the SCRIs. Without smoothing there is a risk that an index could exhibit short-term fluctuations above and below its threshold, which would not be a desirable outcome. Therefore, a simplified approach is used to determine the smoothed Teranet indices for use in the SCRIs; an average of the last 12 months of each Teranet Index's monthly metropolitan area values must be calculated.

3. Calculation of per capita income

The per capita income for use in the SCRI is determined as:

$$\text{Per capita income} = \frac{1{,}000 \times \text{Household disposable income}}{\text{Population}}$$

where:

i. The "Household disposable income" is a quarterly data series from the CANSIM table 380-0072. The data characteristics for this table necessary to calculate the per capita income are:

- Estimates = Household disposable income (× 1,000,000)
- Geography = Canada
- Seasonal adjustment = Seasonally adjusted at annual rates

ii. The "Population" is a monthly data series and is part of the CANSIM table 282-0087. The data characteristics for this table necessary to calculate the per capita income are:

- Labour force characteristics = Population (× 1,000)

- Geography = Canada
- Sex = Both sexes
- Age group = 15 years and over
- Data type = Seasonally adjusted

To determine the "Per capita income" on a quarterly basis, the "Population" data series must be converted from a monthly basis to a quarterly basis by calculating a three month average of the data series.

4. Calculation of metropolitan area SCRIs

The quarterly SCRI before scaling for each metropolitan area is determined as:

$$\text{SCRI before scaling} = \frac{\text{Smoothed quarter-end Teranet house price index for a metropolitan area}}{\text{Per capita income}}$$

The SCRI for a metropolitan area needs to be scaled before being compared to the threshold values to determine whether the mortgages originated in that area are subject to a supplementary capital requirement. The SCRIs are determined by multiplying the ratio of the smoothed Teranet index for a metropolitan area over the per capita income by the scaling factors in the following table.

Metropolitan area	Scaling factor
Calgary	2,500
Edmonton	2,100
Halifax	1,900
Hamilton	2,000
Montréal	2,500
Ottawa-Gatineau	2,400
Québec	1,700
Toronto	3,300
Vancouver	4,200
Victoria	3,300
Winnipeg	1,400

5. Threshold values

Each metropolitan area has its own threshold value that has been determined by OSFI using an algorithm that ensured consistency across metropolitan areas[8]. Threshold values will remain stable over time but are subject to periodic review.

[8] In particular, the threshold value for a particular metropolitan area is given by the formula:
Threshold = Average SCRI + K, where
$K = \alpha \times$ *Average SCRI* $+ \beta \times$ *Standard Deviation*,

The following table shows the threshold values for each metropolitan area used to determine whether a newly originated mortgage in a given area is subject to a supplementary capital requirement. For each metropolitan area, if the calculated SCRI has breached its threshold value then effective the beginning of the next quarterly fiscal reporting period, any mortgage loan originated in that area is subject to the supplementary capital requirement for the life of the loan.

Metropolitan area	Threshold values
Calgary	10.0
Edmonton	9.0
Halifax	8.5
Hamilton	9.5
Montréal	11.0
Ottawa-Gatineau	11.0
Québec	9.0
Toronto	14.0
Vancouver	18.5
Victoria	12.5
Winnipeg	7.5

Exposures in those areas remain subject to the supplementary capital requirements until the SCRI for a metropolitan area falls below the threshold value. In this case, the supplementary capital requirement would no longer be required for mortgage loans originated in the next quarterly fiscal reporting period.

6. Timing of the calculation

The following table provides a summary of the timing for performing the SCRI calculation and determining when the supplementary capital requirement applies.

As at date for data	SCRI calculations performed[9]	Application of supplementary capital requirements
December 31	March 1	April 1
March 31	June 1	July 1
June 30	September 1	October 1
September 30	December 1	January 1

and where the quantities α and β are the same for all metropolitan areas and are assumed to be non-negative. The average and standard deviation are specific to each metropolitan area and are determined based on the experience over historical periods that are not considered to be outside the tail of the distribution.

9 The dates presented are approximate; they may vary according to the CANSIM table 380-0072 release date.

7. Example

This example illustrates how to calculate the SCRIs for Q4 2015 for the 11 metropolitan areas in the Teranet index.

Step 1: Calculation of metropolitan area smoothed Teranet indices

The following table provides the monthly Teranet values for the 11 metropolitan areas for 2015 as well as the December 2015 smoothed values (determined as the 12-month average of the January through December 2015 values).

2015	Calgary	Edmonton	Halifax	Hamilton	Montréal	Ottawa-Gatineau
January	184.68	182.74	137.60	157.15	146.81	140.58
February	184.10	181.24	136.72	157.60	146.42	137.65
March	184.45	181.93	138.36	157.07	147.49	137.20
April	184.85	183.11	139.39	156.99	148.92	136.30
May	178.84	184.28	142.62	157.97	151.34	138.30
June	183.23	184.27	142.05	161.85	152.61	140.58
July	179.75	182.93	140.56	166.27	153.10	143.75
August	186.70	182.02	140.05	170.33	152.35	144.64
September	187.98	182.04	142.71	172.53	151.72	143.88
October	186.51	182.33	140.30	172.08	151.32	143.00
November	184.20	180.77	138.32	172.52	151.65	141.22
December	181.10	180.21	140.45	171.51	149.74	139.19
December smoothed	183.87	182.32	139.93	164.49	150.29	140.52

2015	Québec	Toronto	Vancouver	Victoria	Winnipeg
January	173.71	166.18	185.94	139.41	194.74
February	173.46	165.99	188.66	140.04	192.88
March	176.09	166.42	189.14	139.70	193.33
April	179.12	166.44	189.20	139.47	197.00
May	180.71	169.10	191.58	140.19	197.39
June	179.74	171.86	193.90	143.87	196.80
July	178.61	175.91	196.94	146.36	195.89
August	176.59	178.75	198.08	145.89	197.08
September	173.15	179.79	201.20	147.08	194.32
October	172.84	180.35	202.42	147.55	198.09
November	173.58	180.53	205.15	150.15	197.48
December	174.52	180.82	207.40	150.17	194.55
December smoothed	176.01	173.51	195.80	144.16	195.80

Step 2: Calculation of per capita income

Given the following values for the data series "Household disposable income" (CANSIM table 380-0072) and "Population" data series (CANSIM table 282-0087), the per capita income for Q4 2015 is determined as follows. The average population has to be rounded to the first decimal.

	2015	Statistics Canada data estimates
Household disposable income	Q4	1,131,400
Population	October	29,377.5
	November	29,401.2
	December	29,419.0
	Q4 (Average of October – December)	29,399.2

Then the per capita income for Q4 2015 is:

$$\frac{1{,}000 \times 1{,}131{,}400}{29{,}399.2} = 38{,}484.0$$

The per capita income value has to be rounded to the first decimal.

Step 3: Calculation of metropolitan area SCRIs

Using the December 2015 smoothed Teranet values for the 11 metropolitan areas and the per capita income for Q4 2015, the SCRIS before and after scaling as at Q4 2015 are as follows. The SCRI before scaling has to be rounded to the fifth decimal, while the final SCRI has to be rounded to the second decimal.

Metropolitan area	Dec. 2015 Teranet index smoothed (H)	Q4 2015 SCRI before scaling $\left(\frac{H}{I}\right)$	Scaling Factor (s)	Q4 2015 SCRIs $\left(\frac{H}{I} \times s\right)$
Calgary	183.87	0.00478	2,500	11.95
Edmonton	182.32	0.00474	2,100	9.95
Halifax	139.93	0.00364	1,900	6.92
Hamilton	164.49	0.00427	2,000	8.54
Montréal	150.29	0.00391	2,500	9.78
Ottawa-Gatineau	140.52	0.00365	2,400	8.76
Québec	176.01	0.00457	1,700	7.77
Toronto	173.51	0.00451	3,300	14.88
Vancouver	195.80	0.00509	4,200	21.38
Victoria	144.16	0.00375	3,300	12.38
Winnipeg	195.80	0.00509	1,400	7.13

Where for example the Calgary Q4 2015 SCRI before scaling $\left(\frac{H}{I}\right)$ is determined as:

$$\frac{183.87}{38{,}484.0} = 0.00478$$

And the SCRI would be calculated as:

$$0.00478 \times 2{,}500 = 11.95$$

As the threshold value is set at 10.0 for Calgary, had this Advisory been in effect in Q2-2016, the supplementary capital requirements would therefore have applied for the life of a mortgage loan originated in the Calgary metropolitan area during that reporting quarter.

- END -