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# Technical Paper on the Additional Canada Pension Plan Regulations

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## I. Executive Summary

### A. Purpose

This is the twentieth actuarial study to be published by the Office of the Chief Actuary (OCA). All the findings of this study are based on the 29<sup>th</sup> Actuarial Report supplementing the 27<sup>th</sup> and 28<sup>th</sup> Actuarial Reports on the Canada Pension Plan as at 31 December 2015 (“CPP29”).

This study is undertaken as a supplement to the pre-publication in the *Canada Gazette, Part I*, Volume 152, Issue No. 42, October 20 2018<sup>1</sup>, of the proposed regulations in respect of the Canada Pension Plan (CPP or the Plan): the *Calculation of Contribution Rates Regulations, 2018* and *Additional Canada Pension Plan Sustainability Regulations*. This study provides technical information on the methodology presented in these regulations and discusses their applications.

### B. Scope

The Regulatory Impact Analysis Statement (“RIAS”) that accompanies the proposed regulations states:

“This regulatory proposal aims to ensure that the enhanced portion of the Plan is appropriately funded over time while respecting intergenerational equity, consistent with the full funding principle underpinning the CPP enhancement.”

The *Calculation of Contribution Rates Regulations, 2018* (the “Contribution Rates Regulations”) replace the 2007 version of such Regulations and define methodologies for calculating the contribution rates for both the base and additional CPP. Section II of the study analyses the methodology used for the additional Plan contribution rates defined by these Regulations.

Certain provisions of *Additional Canada Pension Plan Sustainability Regulations* (the “additional CPP Sustainability Regulations”) are expected to be activated in the event that the additional contribution rates, as determined under a CPP actuarial report, deviate to a certain extent from their respective legislated additional rates and the federal and provincial Ministers of Finance do not reach an agreement on how to address such deviation. The additional CPP Sustainability Regulations quantify this deviation with respect to both the magnitude and duration of time that a deviation exists and describe actions to be taken to address the deviation. Section III of the study discusses the design of the additional CPP Sustainability Regulations, analyses the potential frequency of activation of these provisions and the way they are applied.

Lastly, Appendices A to H provide technical, legislative and international backgrounds used for the analysis of the additional CPP Sustainability Regulations, discuss applications of these Regulations in special cases, present the references, and list the people who participated in the work on this study.

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<sup>1</sup> This publication can be accessed at: <http://www.gazette.gc.ca/rp-pr/p1/2018/2018-10-20/pdf/g1-15242.pdf>

## C. Main Findings

- The methodology for calculating the contribution rates for the additional Plan defined in the Contribution Rates Regulations:
  - takes into account multiple generations of the additional Plan's participants,
  - ensures the long-term sufficiency and stability of additional contribution rates as required by paragraph 113.1(4)(d) of the *Canada Pension Plan*, and
  - produces appropriate results for different economic and demographic environments.
- The additional CPP Sustainability Regulations are designed with the goal of:
  - preserving the financial sustainability of the additional CPP (i.e. preventing both substantial underfunding and overfunding),
  - ensuring the stability of additional CPP contribution rates, and
  - reducing the risk of future reductions in benefits and/or increases in the contribution rates.
- The structure of the sustainability provisions for the additional CPP differs from the one used for the base Plan as defined in the CPP statute due to differences between the base and additional Plan in respect of: the plan designs, financing approaches, ways in which intergenerational equity is addressed, the context in which the sustainability provisions were introduced, and the levels of plan maturity.
- The design of the additional CPP Sustainability Regulations aims at limiting the frequency and magnitude of adjustments without jeopardizing the financial sustainability of the additional CPP.
- The analysis presented in this study indicates that under the risk/return profile of the investment portfolio assumed in CPP29 there is a small to negligible probability that the provisions of the additional CPP Sustainability Regulations would need to be activated over the first two decades following the inception of the additional CPP.
- The actions defined by the additional CPP Sustainability Regulations affect both the benefits of current and future beneficiaries and contributions, if needed. These actions are based on the following principles:
  - Actions need to be taken in the case of significant overfunding (surplus) or underfunding (deficit) of the additional Plan; however, there is a higher tolerance in a surplus situation.
  - The first action to be taken is a reversal of any previous adjustments.
  - In the case of a surplus, benefits of current and future beneficiaries are increased.
  - In the case of a deficit, the adjustments are shared between employers, contributors and beneficiaries through, first, adjusting benefits, and then adjusting contribution rates, only if necessary.



- The higher emphasis placed on benefit adjustments over contribution rates adjustments mitigates future impacts on younger generations of participants, and thus preserves intergenerational equity.

## **D. Conclusion**

The additional CPP Sustainability Regulations are aimed at preserving the financial sustainability of the additional Plan (i.e. preventing both substantial surplus or deficit), ensuring the stability of contribution rates, and reducing the risk of future reductions in benefits and/or increases in the contribution rates.

The additional CPP Sustainability Regulations are a default mechanism that would apply only if the additional contribution rates necessary to sustain the additional Plan differ significantly from the legislated rates and the federal and provincial Finance Ministers do not reach agreement on a course of actions.

The design of the additional CPP Sustainability Regulations shares adjustments between current beneficiaries, contributors and their employers. It aims at minimizing intergenerational transfers to be consistent with the design and financing objectives of the additional Plan, and provides to all generations of Canadians the confidence of being treated fairly.

## II. Calculation of the FAMCR and SAMCR

### A. Introduction

According to paragraph 113.1(4)(d) of the *Canada Pension Plan* (the “Act”), the additional retirement, survivor, and disability benefits provided by the additional Plan are to be financed through additional contribution rates that are no lower than the rates:

“(i) that, beginning with the year 2024, are the lowest constant rates that can be maintained over the foreseeable future, and

(ii) that result in projected contributions and investment income that are sufficient to fully pay the projected expenditures of the additional Canada Pension Plan over the foreseeable future;...”

These rates are to be determined by the OCA of the Office of the Superintendent of Financial Institutions Canada (OSFI) in accordance with the Regulations prescribing the calculation of the rates. These Regulations are referenced in paragraphs 115(1.1)(d) and (e) of the *Canada Pension Plan* (the full text can be found in Appendix B of this study).

Regulations already exist regarding the calculation of the minimum contribution rate (MCR) under the base Plan defined in paragraph 115(1.1)(c), namely the *Calculation of Contribution Rates Regulations, 2007*. The underlying principle of these Regulations is that the ratio of the base CPP end of year assets to its following year’s expenditures (A/E ratio) in the 60<sup>th</sup> year following a three-year financial review period is not lower than the A/E ratio in the 10<sup>th</sup> year following the period.

The *Calculation of Contribution Rates Regulations, 2018* (the “Contribution Rates Regulations”) replace the 2007 version and define methodologies for calculating the contribution rates for both the base and additional Plans.

While the methodology for the additional CPP defined under these Regulations retains some of the aspects of the one for the base CPP, such as the use of the A/E ratio, it is conceptually different. Two main reasons for such differences are the different financing approaches of the two Plans, as well as the fact that while the base CPP is a mature program, the additional Plan will reach maturity only by about 2090.

The main purpose of Part II of the study is to analyse the methodology as described in the new Contribution Rates Regulations associated with the calculation of the first and second additional minimum contribution rates (FAMCR and SACMR) within the framework defined by paragraph 113.1(4)(d) of the *Canada Pension Plan*.

### B. Methodology to Determine the Additional Minimum Contribution Rates

The FAMCR and SAMCR are defined as the minimum constant contribution rates applicable from the year 2024, or after a three-year period for which a review is required by subsection 113.1(1) of the *Canada Pension Plan*, if later, that meet the following three conditions specified in section 4 of the Contribution Rates Regulations:

- (a) Paragraph 4(1)(a) requires the ratio of the SAMCR to the FAMCR to be equal to the ratio of the percentage specified in paragraph 46(1)(c) to the percentage specified in paragraph 46(1)(b) of the *Canada Pension Plan* (currently equal to  $4 = 33.33\% / 8.33\%$ ),
- (b) Paragraph 4(1)(b) specifies that the open group assets of the additional CPP need to be at least 100% of its open group actuarial liability at the actuarial valuation date, and
- (c) Paragraph 4(1)(c) and subsection 4(2) require the projected ratio of additional assets to additional expenditures for the 60<sup>th</sup> year after the review period but not earlier than 2098 to be not lower than the projected ratio of assets to expenditures for the 50<sup>th</sup> year after the review period, but not earlier than 2088.

As per subsection 4(3), the FAMCR for the years 2022 and 2023 is determined by multiplying the rate determined for the year 2024 by 0.75 and 1.00, respectively.

The FAMCR and SAMCR are each determined to the smallest multiple of 0.0001 percentage points. The rates are then each rounded to the nearest multiple of 0.01 percentage points, or if equidistant from the two multiples, to the higher multiple.

For the remainder of this study, the “the 50<sup>th</sup> year after the review period but not earlier than 2088” is called the First Stabilization Year (FSY), and “the 60<sup>th</sup> year after the review period but not earlier than 2098” is called the Second Stabilization Year (SSY).

It should be noted that there is no need to define the FAMCR for years 2019 to 2021, since the legislated rates will apply for these years. Moreover, this methodology provides a degree of consistency with the methodology used for the calculation of the steady-state rate for the base CPP as specified in section 2 of the Contribution Rates Regulations. First, both methodologies use the concept of the A/E ratio. Second, they both use the 60<sup>th</sup> year following the end of the review period as the last point in the future for testing the A/E ratio. Finally, under both methodologies, the legislated contribution rates are applied during the first three years following the date of the actuarial valuation (i.e. during the corresponding review period).

The methodology defined by the Contribution Rates Regulations was used for the purpose of the CPP29.

To determine the actuarial liability of the additional Plan on an open group basis, future additional expenditures with respect to current and future additional CPP participants are projected using the best-estimate assumptions of CPP29 (Appendix A provides a summary of the best-estimate assumptions). The open group actuarial liability is then the present value of these projected additional expenditures discounted using the assumed nominal rate of return on additional CPP assets.

To determine the open group assets of the additional Plan, future additional contributions of current and future contributors are projected using the best-estimate assumptions of CPP29. In order to determine their present value, the projected additional contributions are discounted using the assumed nominal rate of return on the additional CPP assets. This present value is added to the invested assets of the additional Plan to obtain the total open group assets.

CPP29 uses a projection period of 150 years from the valuation date to determine the open group assets and actuarial liability of the additional CPP. Two main considerations are taken into account when deciding on the length of the projection period to use to determine the open group assets and actuarial liability of the additional CPP.

First, by using a finite projection period, some of the future expenditures of cohorts who will enter the labour force during that period are excluded from the open group actuarial liability. However, a greater proportion of the contributions for these cohorts are included in the open group assets. Thus, even taking into account the discounting of future cash flows of the additional Plan, using an insufficiently long projection period may overestimate the open group assets as a percentage of its actuarial liability. However, this must be weighed against a second consideration that although increasing the length of the projection period allows for a more complete assessment of the financial sustainability of the additional CPP, it also increases the uncertainty of the results. As discussed in detail in Section III.E of the OCA's Actuarial Study No.19: *Measuring and Reporting Actuarial Obligations of the Canada Pension Plan*, a projection period of 150 years achieves a balance between the accuracy and uncertainty of results.

Paragraph 4(1)(b) of the Contribution Rates Regulations and, in particular, the requirement to use the open group approach, satisfy the requirement of "sufficiency" formulated in the subparagraph 113.1(4)(d)(ii) of the *Canada Pension Plan*. Since the open group methodology is based on projections of future income and expenditures, the requirement of the additional CPP open group assets to be at least 100% of its open group actuarial liability ensures that, at the valuation date, the projected additional contributions and investment income are sufficient to cover the projected additional expenditures over the long term.

Paragraph 4(1)(c) and subsection 4(2) address the requirement of subparagraph 113.1(4)(d)(i) regarding the stability of the additional minimum contribution rates (AMCRs) over the long term. The stability of the AMCRs means, in particular, that under those rates the additional CPP open group assets are not less than the open group liability at any point of time in the foreseeable future (assuming that the assumptions of the actuarial valuation report are realized). However, such an approach would presume a substantial increase in the length of the projection period. For example, to determine the open group assets and liabilities of the additional CPP in 50 years after the valuation date, the initial projection period of 150 years would need to be extended by another 50 years to reach 200 years. Due to the very high uncertainty of such projections, the usefulness of such measures could be questioned.

Therefore, the Contribution Rates Regulations introduce an alternative measure - the stability of the A/E ratio of the additional CPP - which is aimed at ensuring the adequacy of future projected contributions and investment income to cover projected expenditures without projecting changes in the additional contribution rates. The level of the A/E ratio may serve as a proxy of the funded status of the additional Plan.

The FAMCR and SAMCR determined under CPP29 using the methodology defined in the Contribution Rates Regulations are 1.98% for years 2023 and thereafter and 7.92% for years 2024 and thereafter, respectively. It should be noted that if this methodology were applied to the additional Plan assuming the plan provisions at the time of the preparation of the 28<sup>th</sup> Actuarial Report supplementing

the 27<sup>th</sup> Actuarial Report on the Canada Pension Plan as at 31 December 2015 (“CPP28”), then the AMCRs would be the same as presented in CPP28, where a slightly different methodology was used.

The Contribution Rates Regulations were developed to stabilize the AMCRs over the long term. The next two sections present an analysis of the impacts of different stabilization years on the AMCRs and the responsiveness of the Regulations methodology to different key assumptions.

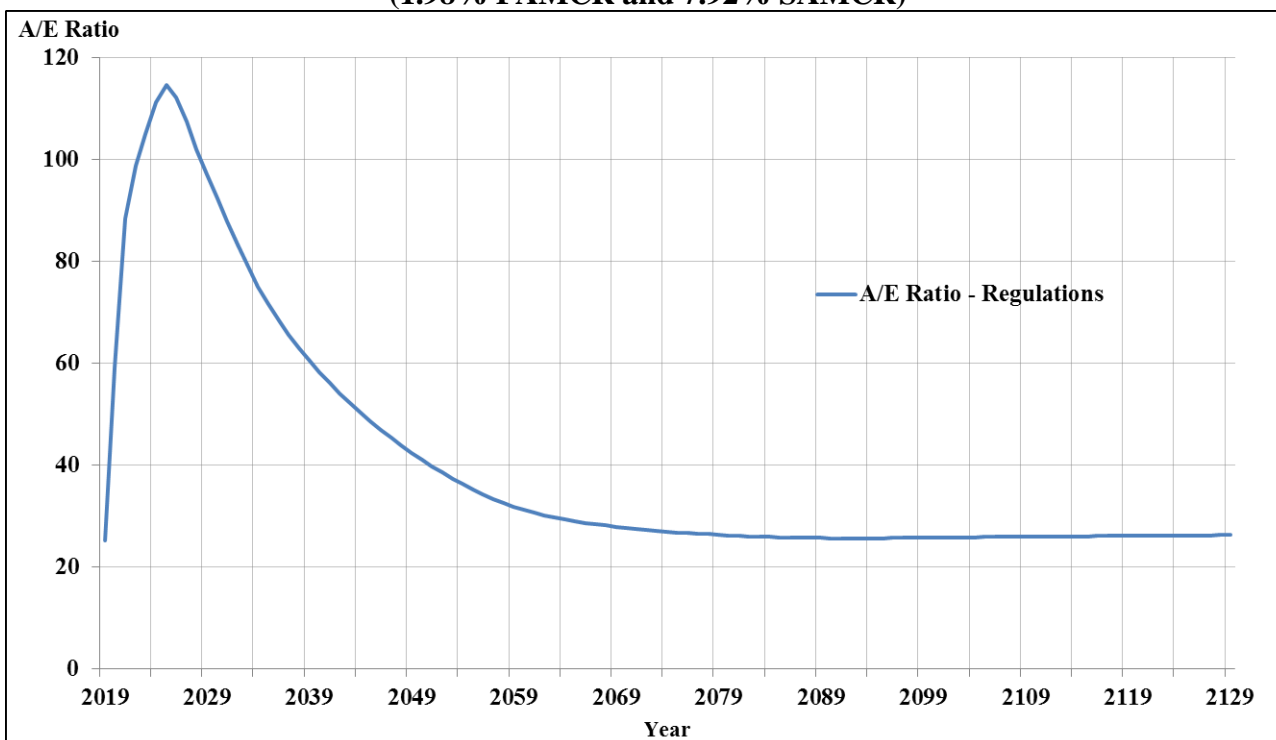
### **C. Impact of Various First and Second Stabilization Years on AMCRs and Level of Funding of the Additional CPP**

This section discusses different combinations of the FSY and SSY and their impact on the AMCRs and level of funding of the additional Plan under the best-estimate assumptions of CPP29.

The FSY and SSY for the first review period of 2019 to 2021 are defined to be years 2088 and 2098, respectively. As mentioned in the previous section, the first and second AMCRs determined using these stabilization years are 1.98% for the year 2023 and thereafter and 7.92% for the year 2024 and thereafter, respectively.

Chart 1 presents the evolution of the A/E ratio of the additional Plan under these AMCRs. As shown, the A/E ratio is very high in the early years due to significant revenues from contributions and investment income as compared to much lower expenditures. Thereafter, as projected expenditures increase due to the increase in the number of beneficiaries and to the increase in the size of new benefits, there is a quite rapid and natural decrease in the A/E ratio. In other words, the maturing of the additional CPP leads to the decrease in the initially very high A/E ratio, with the A/E ratio eventually stabilizing at a value close to 26.

**Chart 1 Asset/Expenditure Ratio – Additional CPP, Proposed Regulations  
 (1.98% FAMCR and 7.92% SAMCR)**



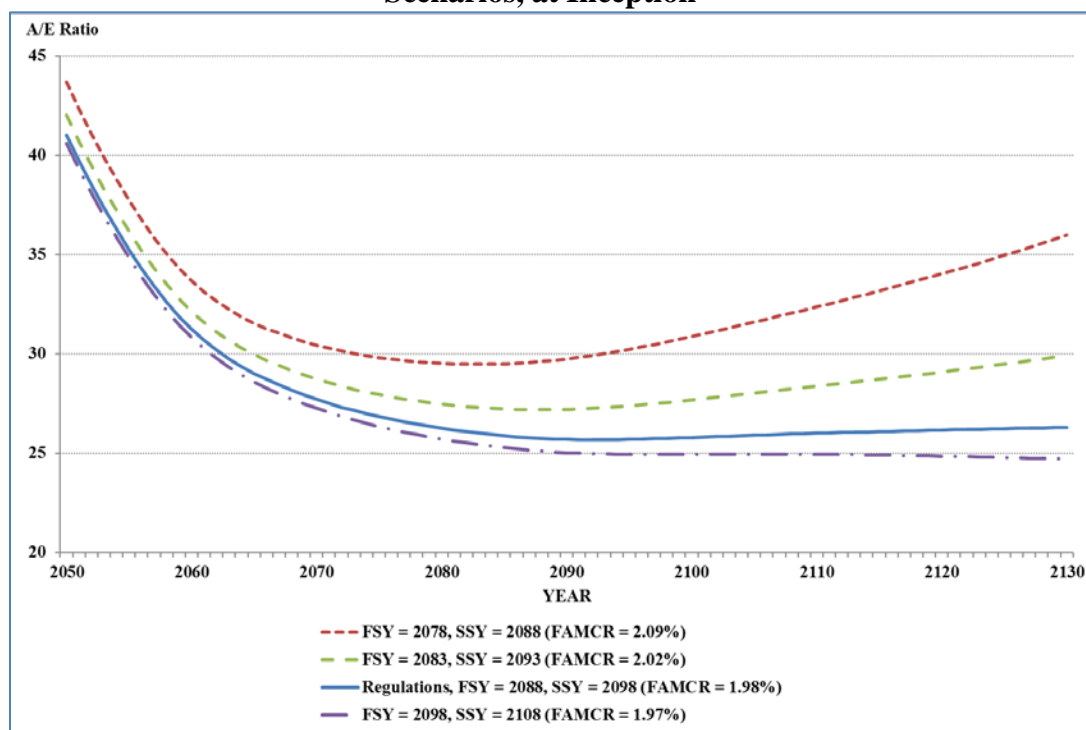
The stabilization years are expected to achieve a balance between the following three objectives:

- (1) The FSY and SSY should be far enough in the future to not interfere with the natural decrease in the A/E ratio resulting from the maturing of the additional Plan,
- (2) The FSY and SSY should not be too far in the future in order to minimize the uncertainty related to the projections, and
- (3) The difference between the SSY and FSY should be minimized to lessen the uncertainty of long-term projections while ensuring the stabilization of the A/E ratio.

Chart 2 shows the projected A/E ratios determined at inception of the additional CPP under different choices of the FSY and SSY as well as under the Regulations methodology using the best-estimate assumptions of CPP29. The projections are shown for years 2050 to 2130.

As can be seen from Chart 2, scenarios with an FSY equal to 2078 or 2083 indicate that the FSY is not far enough from the end of the first review period (2019-21), since these scenarios result in the eventual overfunding of the additional CPP as indicated by the increasing A/E ratios. On the other hand, using a later FSY of 2098 does not result in improved stability of the A/E ratio.

**Chart 2 Asset/Expenditure Ratio – Additional CPP under Different Stabilization Years Scenarios, at Inception<sup>(1)</sup>**



(1) A/E ratios on this chart are based on unrounded AMCRs.

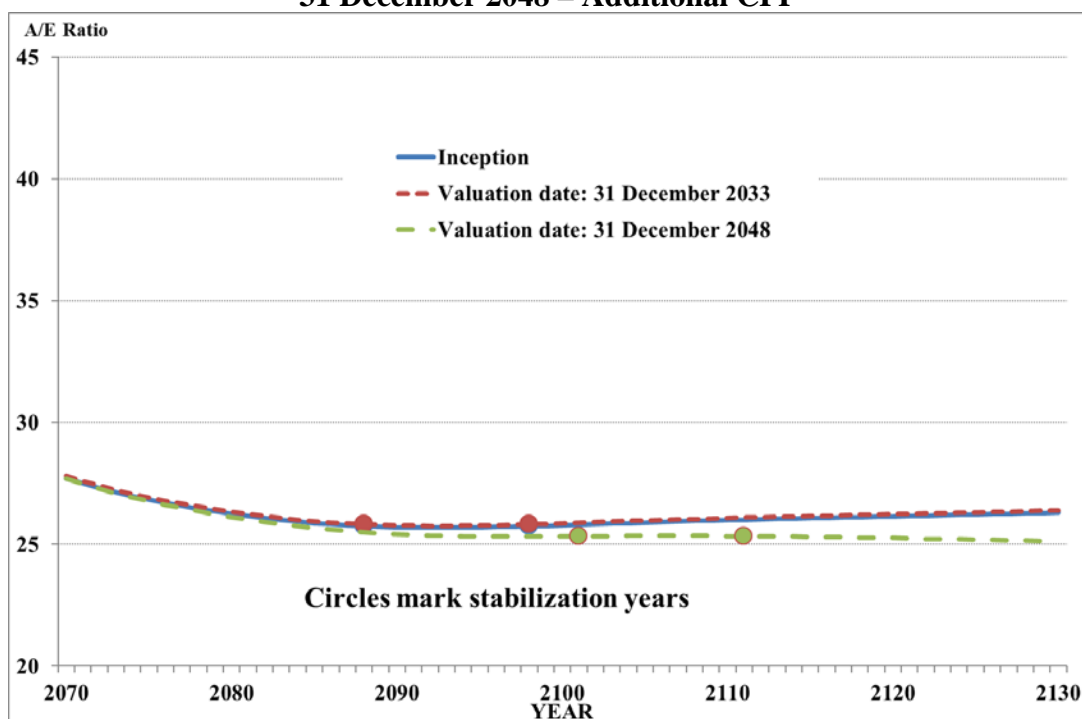
With a FSY at inception fixed at 2088, choosing a SSY at 10, 15 or 20 years after (i.e. a SSY equal to 2098, 2103 or 2108) produces virtually the same AMCRs and levels of the A/E ratios. All else remaining equal, it is preferable to choose a SSY that is closer to the FSY in order to reduce the level of uncertainty in the projections. At the same time, having the FSY and SSY too close does not lead to sufficient stability in the A/E ratio projected beyond the SSY. For instance, choosing a second stabilization year of 2093 (only 5 years after the FSY) leads to an FAMCR of 2.00%, an increasing A/E ratio, and the overfunding of the additional Plan.

As a result, it can be concluded that the choice of first and second stabilization years of 2088 and 2098, respectively, at the inception date balances the objectives formulated above.

Chart 3 illustrates that the FSY and SSY defined by the Contribution Rates Regulations results in relatively stable projected A/E ratios at the valuation dates 15 and 30 years following the inception of the additional CPP (i.e., as at 31 December 2033 and 2048).<sup>2</sup> Under the Regulations methodology, the A/E ratios at the FSY as determined as at 31 December 2018, 2033, and 2048 are 25.7, 25.8, and 25.3, respectively.

<sup>2</sup> The A/E ratios at the future valuation dates are projected using the best-estimate assumptions of CPP29 and assuming that these assumptions are realized prior to these valuation dates.

**Chart 3 Asset/Expenditure Ratio as Projected at Inception, 31 December 2033 and 31 December 2048 – Additional CPP**



#### D. Sensitivity of Proposed Methodology to Changes in Key Assumptions

This section discusses the appropriateness of the Contribution Rates Regulations methodology under low- and high-cost scenarios with respect to three key assumptions that have significant impacts on the cost of the additional Plan: mortality rates, real wage increases, and the real rate of return. The alternative assumptions selected are intended to represent a wide range of potential long-term experience. These alternative assumptions are the same ones used in CPP28 (Table 16 of that report) to show the uncertainty of results of the best-estimate projections of the additional CPP. Table 1 summarizes the alternative assumptions.

**Table 1 Sensitivity Test Assumptions**

Canada	Low-Cost		Best-Estimate		High-Cost	
1 Mortality						
Canadian life expectancy at age 65 in 2050 with future mortality improvements	Males	20.9	Males	23.3	Males	25.8
	Females	23.2	Females	25.6	Females	27.9
2 Real wage increase	0.4%		1.1%		1.8%	
3 75-year average real rate of return (2019-2093)	4.55%		3.55%		2.55%	

Chart 4 shows that the Contribution Rates Regulations methodology is successful in stabilizing the A/E ratios and thus the contribution rates, which in turn ensures and maintains the appropriate funding state of the additional CPP under a variety of demographic and economic environments.

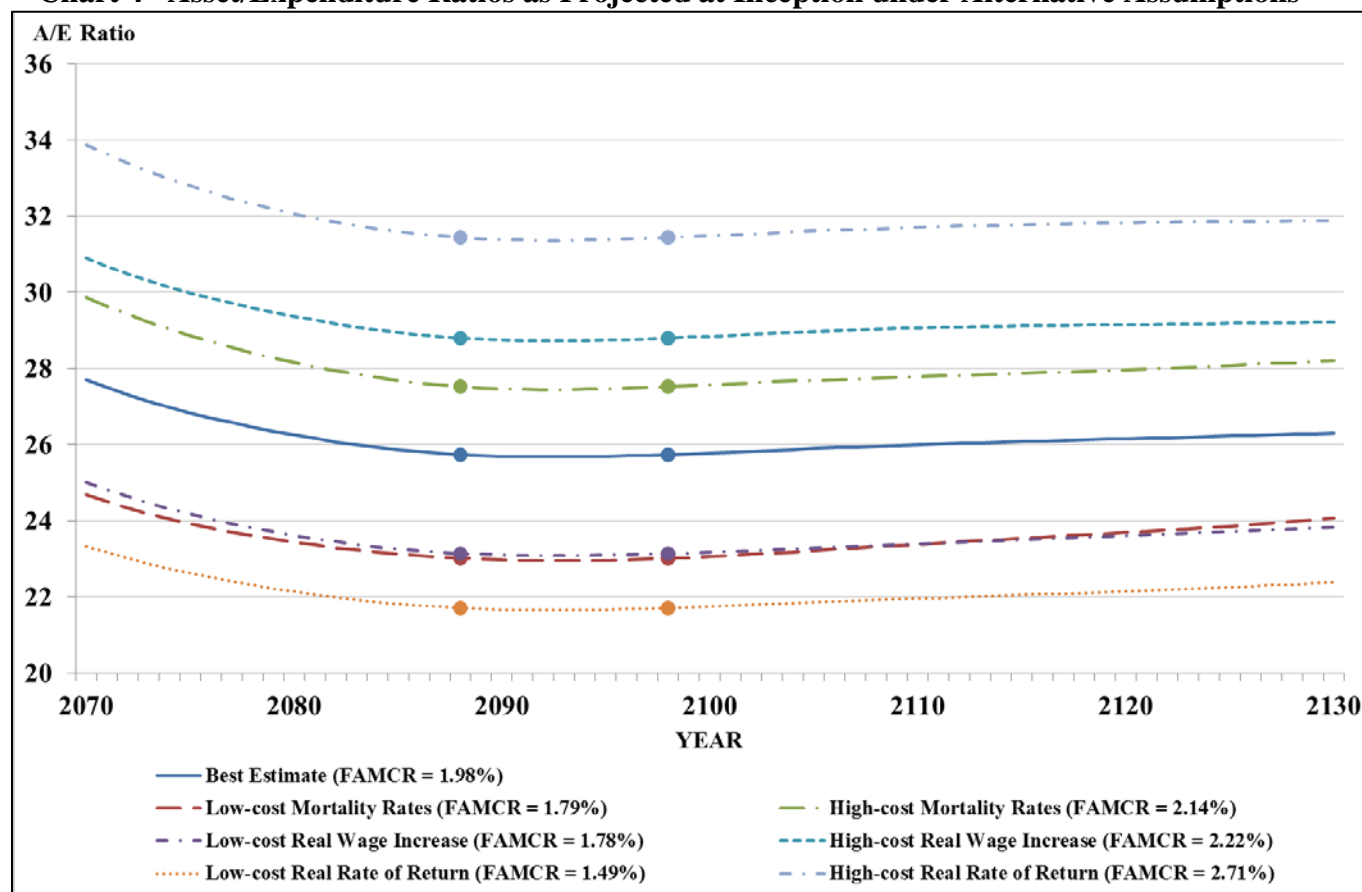


The higher level at which the A/E ratios stabilize under the high-cost tests compared to the low-cost tests is a direct result of the timing of the inflow of contributions and outflow of expenditures.

Under the high-cost mortality test (increased life expectancies), benefit expenditures increase, which in turn results in higher AMCRs (FAMCR of 2.14%). While the increase in expenditures occurs in the medium to long term, the higher contribution rates and contributions are paid almost immediately, with higher assets accumulating from the early years onward. This higher accumulation of assets outweighs the eventual increase in expenditures and results in the A/E ratio stabilizing at a level of about 28 compared to 26 under the best-estimate assumption. Similar reasoning applies for the higher stabilized A/E ratios under the high-cost real-wage increase test.

Under the high-cost test for the real rate of return, the increase in the AMCRs is quite significant: the FAMCR increases to 2.71% from 1.98% under the best-estimate scenario. Since the sensitivity test is applied at the additional Plan's inception, the increase in the AMCRs and hence higher accumulation of assets relative to low expenditures in the early years outweighs the assumed lower rates of return and leads to higher stabilized A/E ratios in the long term.

**Chart 4 Asset/Expenditure Ratios as Projected at Inception under Alternative Assumptions**



### III. Additional CPP Sustainability Regulations

#### A. Introduction

This Part III discusses the *Additional Canada Pension Plan Sustainability Regulations* (hereafter referred to as the “additional CPP Sustainability Regulations”). Certain provisions of these Regulations are expected to be activated in the event that the FAMCR and SAMCR, as determined under a CPP actuarial report, deviate to a certain extent from their respective legislated additional rates (2.0% and 8.0% for years 2024 and thereafter) and the federal and provincial Ministers of Finance do not agree on how to address the deviation. The deviation is quantified with respect to both the magnitude (absolute basis points difference between the AMCRs and legislated rates) and duration of time that a deviation exists.

As intended, the sustainability provisions are specified in the new Regulations governing the additional CPP. The reference to these provisions and the Regulations is set out in subsections 113.1(11.141) to (11.143) of the *Canada Pension Plan* as amended by Division 19 of Part 6 of Bill C-74, the *Budget Implementation Act, 2018, No. 1*, which received Royal Assent on 21 June 2018 (see Appendix B for the full text).

Specifically, subsection 113.1(11.141) refers to the prescribed ranges of the AMCRs relating to the triggering of the sustainability provisions, and both 113.1(11.141) and (11.142) provide for the actions to be taken under the sustainability provisions: changes to the additional contribution rates and benefits. Subsection (11.143) gives precedence to decisions taken by the federal and provincial Finance Ministers. The prioritizing of decisions of the Finance Ministers in case the sustainability provisions of the additional Plan would otherwise be applied is similar to the structure of the automatic adjustment mechanism of the base CPP. For the base CPP, this automatic adjustment mechanism is set out in the “Insufficient rates” provisions of subsections 113.1(11.05) to (11.14) of the *Canada Pension Plan*. Those provisions set out the automatic increase in the contribution rate and freezing of indexation of benefits in pay in the event the base Plan MCR exceeds the legislated rate and the federal and provincial Ministers of Finance do not decide to either increase or maintain the legislated rate (113.1(11.13)).

#### B. General Considerations

##### 1. Differences in Default Adjustment Provisions of the Base and Additional Plans

The structure of the sustainability provisions for the additional CPP differs from the one used for the base Plan as defined in the CPP statute. There are several reasons why: differences in the context in which the sustainability provisions were introduced for the base CPP compared to the context of the additional CPP, in the designs of the two plans, financing approaches, ways of how intergenerational equity is addressed, and the level of maturity of the two plans.

The insufficient rates provisions of the base CPP were introduced with the intention of avoiding the situation that occurred in the late 1980s and into the 1990s when the contribution rate increased each year. This situation arose from an inadequate contribution rate level given a number of factors, namely: lower birth rates, higher life expectancies, lower real wages, benefit enrichments, and

increased numbers of Canadians claiming disability benefits for longer periods, as identified by the Chief Actuary in the 15<sup>th</sup> CPP Actuarial Report (1993).

Moreover, under the financing approach of the base CPP, contributions constitute the main source of the Plan's revenues<sup>3</sup>, and the amount of contributions is driven largely by the demographic factors (fertility, mortality/longevity, migration) of the Canadian population. These factors (especially fertility and longevity) do not change overnight, and their impacts are long term. Therefore, it is appropriate to respond to changing demographic conditions that put pressure on the sustainability of the base Plan by a permanent increase in the contribution rate that applies to all current and future generations, as provided by the insufficient rates provisions. Further, the temporary freeze in indexation for benefits in pay included as part of these provisions allows for sharing the burden of the adjustment between contributors and beneficiaries. Finally, the insufficient rates provisions of the base CPP do not include any provisions for the reversal of changes previously made.

The default adjustments for the base CPP are thus based on a permanent increase in the contribution rate for current and future generations and a permanent slowdown in the growth in benefits for individuals who were beneficiaries at the time the adjustments were made.

For the additional Plan, the legislated additional contribution rates are set in such a way as to be sufficient together with the projected investment income to pay for benefits over the long term. Further, for the additional Plan, it is possible that even if short-term experience (driven in large part by investment volatility) resulted in the AMCRs deviating from the legislated rates, the AMCRs could still revert to the legislated rates without any adjustments being made. Moreover, a situation could also arise that, after adjustments have been made to lower or increase the AMCRs, emerging experience would lead to more adjustments being needed but in the opposite direction. Therefore, the additional CPP Sustainability Regulations aim at being a default course of correction, which may not be necessarily permanent and could be reversed later on.

Intergenerational equity is also addressed differently between the two Plans. When the base Plan was introduced in 1966, the goal of a relatively quick reduction of poverty among seniors was more important at that time than the achievement of intergenerational equity. The move from pay-as-you-go to partial financing as part of the changes introduced in 1997 acted to improve intergenerational equity for the base Plan, but was not aimed at fully restoring it. In comparison, intergenerational equity is a key element of the additional Plan, which is reflected in the design of the additional Plan through the gradual accrual of benefits as well as through its financing objectives.

Finally, it is worth emphasizing that, for both the base and additional CPP, the default adjustment provisions would only be invoked in the event that a deviation arises between the (additional) minimum contribution rates and their respective legislated rates and the federal and provincial Finance Ministers do not agree how to address this deviation. For the base Plan, the deviation would result from the MCR being above the legislated rate, whereas, as discussed in the next section, the deviation for the additional Plan would result if the AMCRs were either substantially above or below the legislated rates.

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<sup>3</sup> As shown by Chart 1 of CPP28, it is projected that by 2050 about two thirds of the base CPP revenues will be coming from contributions.

## **2. Overall Considerations for the Additional CPP Sustainability Provisions**

As stated in the RIAS, the proposed additional CPP Sustainability Regulations aim to ensure that the enhanced portion of the Plan is appropriately funded over time while respecting intergenerational equity, consistent with the full funding principle underpinning the CPP enhancement.

As a result, the design of the additional CPP Sustainability Regulations is aimed at preserving the financial sustainability of the additional CPP (i.e. preventing both substantial underfunding and overfunding), ensuring the stability of contribution rates, and reducing the risk of future reductions in benefits and/or increases in the contribution rates.

The provisions of these Regulations define the frequency with which adjustments are made, the magnitude of the adjustments, and the nature of the adjustments in situations when the AMCRs are “too high” or “too low”. For the remainder of this study, a situation when the AMCRs are below the legislated contribution rates is referred to as a “surplus”, and a situation when the AMCRs are above the legislated contribution rates is referred to as a “deficit”.

The provisions establish a default adjustment mechanism that is considered reasonable by the Finance Ministers in terms of the default set of actions that could be taken, the nature and frequency of the changes, and the effect of those changes on the additional Plan participants and their employers.

Very frequent changes in the additional Plan’s parameters may create uncertainty in the public’s expectations and erode trust in the additional Plan. On the other hand, having less frequent adjustments may result in an increase in the magnitude of the adjustments when they occur. In general, either excessively frequent or less frequent but large adjustments are not a desirable feature of a default adjustment mechanism and, as such, a balance needs to be achieved between the frequency and magnitude of adjustments. Public perception of the strength of the additional Plan’s financial state and the extent to which the additional Plan’s financial state is jeopardized or considered volatile is an important consideration.

The extent to which the AMCRs deviate from the legislated rates, that is, the ranges of AMCRs along with the frequency of required adjustments are defined accordingly. These definitions are, in particular, based on three principles:

- The first one is to minimize the frequency and magnitude of adjustments over the first two decades following the inception of the additional Plan, a period when the assets are accumulating and benefit payments are quite modest.
- The second principle is that if the AMCRs are determined to be within a certain range of the legislated rates that does not require any actions, then there should be a reasonable likelihood that the AMCRs will remain within this range. As illustrated later in this study, the OCA estimates that such likelihood in the long term is about 50 per cent based on the ranges defined in the additional CPP Sustainability Regulations.
- Lastly, and most importantly, the final principle is minimizing the risk of reductions in benefits and/or increases in contributions. In particular, this is achieved through allowing a higher

deviation of the AMCRs from the legislated rates in a surplus situation as compared to a deficit situation.

These principles allow for limiting the frequency and magnitude of adjustments without jeopardizing the financial sustainability of the additional CPP.

It is important that when adjustments are made, they are applied equitably to both current beneficiaries and future beneficiaries (current and future contributors). The design of the additional CPP Sustainability Regulations aims at minimizing intergenerational transfers to be consistent with the design and financing objectives of the additional Plan, and provides to all generations of Canadians the confidence of being treated fairly. So, while the sustainability provisions are based on actuarially sound principles, it is also important that the provisions be perceived overall as being fair by different generations. However, it needs to be recognized that given the complexity of the additional Plan, the fact that it is a social security program that covers multiple cohorts of Canadian workers (other than in Québec), and that there is no clear and unique definition of intergenerational fairness for social security programs<sup>4</sup>, it is hence not possible to design a default mechanism that will be actuarially fair to every individual.

It is important that all Plan stakeholders (current and future beneficiaries as well as their employers) share in the adjustments, particularly in the event of a deficit.

Adjusting the benefits of current beneficiaries is the only way to ensure that they are affected by both positive and negative developments. Therefore, such adjustments to benefits in pay are a part of the sustainability provisions of the additional CPP. This is achieved through modifying the cost-of-living adjustments for a certain number of years following the end of a review period when the provisions of the additional CPP Sustainability Regulations are invoked. Importantly, the mechanism defined by these Regulations preserves the amount of benefits in pay at the time the sustainability provisions are activated, and adjust only the pace of future increases in benefits coming from the indexation. When benefits grow more slowly than inflation, current beneficiaries, especially older ones, may have difficulty to adapt to lower income. The Regulations act to limit the impact of reductions in indexation on existing benefits.

Adjusting benefits of future beneficiaries (i.e. current and future contributors) along with benefits of current beneficiaries is a transparent way to ensure intergenerational equity. This is achieved through multiplying benefits coming into pay in each year following the end of a review period when the Regulations are invoked by a factor called “benefit multiplier”. The benefit multiplier has a default value of one unless the Regulations are invoked. If the Regulations are invoked in the case of surplus, then the benefit multiplier is higher than one, and, in the case of deficit, the benefit multiplier is lower than one. The value of the benefit multiplier depends on the year a benefit commences.

The value of the benefit multiplier is determined in such a way that the benefits of both current and future beneficiaries are affected to the same extent (the same percentage increase/reduction). It should be noted that adjusting benefits of current and future beneficiaries is easily reversible.

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<sup>4</sup> For the discussion regarding a concept of the “intergenerational equity” the reader is referred to the paper “Intergenerational Equity: a condition for sustainable social security” [http://www.osfi-bsif.gc.ca/Eng/oca-bac/sp-ds/Pages/issa14\\_rpt2.aspx](http://www.osfi-bsif.gc.ca/Eng/oca-bac/sp-ds/Pages/issa14_rpt2.aspx).

The only way employers could be affected by the application of the sustainability provisions is through changes to the contribution rates. Therefore, the additional CPP Sustainability Regulations include the possibility of an increase in the contribution rates in some deficit situations.

The following describes the principal design features of the actions defined by the additional CPP Sustainability Regulations:

1. The first action to be taken when the sustainability provisions are activated is a reversal of any previous adjustments in an opposite direction. Such reversal should be done to the extent that the AMCRs are restored to their legislated levels as defined by Schedule 2 of the *Canada Pension Plan*.
2. In the case of a surplus, the actions defined by the additional CPP Sustainability Regulations focus on increasing benefits of current and future beneficiaries. These actions are aimed at bringing the AMCRs to target values below the legislated rates (10 basis points (bps) and 40 bps lower than the legislated first and second additional contribution rates, respectively), so they are likely to remain close to the legislated rates for a certain time. The only exception is for when reversals of previously enacted adjustments are done.
3. In the case of a deficit, the additional CPP Sustainability Regulations share the adjustment between employers, contributors and beneficiaries through, first, adjusting benefits, and then adjusting contribution rates, only if necessary. Specifically:
  - a. The benefits of both current and future beneficiaries (retirement, disability, and survivor) would first be adjusted to a specified limit, and
  - b. If such an adjustment to benefits is not sufficient to restore the AMCRs to their respective legislated values, then the additional contribution rates would be deemed to be increased.

It should be noted that the overall goal of the actions in a deficit position is to align the AMCRs with the legislated contribution rates. There are several reasons for this. First, if the AMCRs are not aligned with the legislated rates, but continue to be higher, then there is a greater likelihood that further adjustments will be required again at the next valuation. Moreover, the farther away the AMCRs are from their legislated rates, the greater the chance of adjustments being required. Second, if the AMCRs are adjusted beyond what is required to set them to the legislated rates (i.e. AMCRs are brought back to values below the legislated rates), then current and future beneficiaries would be affected by larger adjustments than necessary to restore the financial sustainability of the additional Plan.

The asymmetric approach of actions in surplus and deficit positions are consistent with the goals of preserving the sustainability of the additional CPP (i.e. preventing both substantial underfunding and overfunding), ensuring stability of the additional contribution rates, and reducing the risk of reductions in benefits and/or increases in the contribution rates. Further, it is flexible (i.e. easily reversible) and equitable.

Finally, it should be noted that actions of the additional CPP Sustainability Regulations that increase/decrease additional contribution rates do not result in a change in the rate as defined by Schedule 2 of the Act. Therefore, contribution rates defined by Schedule 2 are referred to as “legislated rates”, and contributions rates resulting from the application of these Regulations are referred to as “deemed contribution rates”.



The triggers of the sustainability provisions for the Additional CPP and required actions are described in the following sections C and D, respectively. Appendix C presents, for the purpose of comparison, the proposed adjustment mechanism of the previously proposed Ontario Retirement Pension Plan and the mechanisms of other social security systems for selected countries.

The sustainability provisions are meant to maintain the stability of the additional contribution rates through a series of appropriate actions as required. Nonetheless, given the uncertainty regarding the future financial state of the additional CPP, the sustainability provisions may need to be modified at some point in the future to ensure they remain appropriate. Thus, subsection 113.1(11.146) of the *Canada Pension Plan* specifies that in the first review after 2027 and every third review following, the additional CPP Sustainability Regulations are to be reviewed by the federal and provincial Ministers of Finance as part of their triennial review.

## **C. Action Triggers - by How Much, and for How Long, can the AMCRs Deviate from the Legislated Additional Contribution Rates before Actions are Required?**

### **1. Additional CPP Sustainability Regulations: AMCRs Action Ranges**

The additional CPP Sustainability Regulations define which actions should be taken depending on how much the AMCRs deviate from their corresponding legislated rates<sup>5</sup>. This translates into five AMCRs ranges. Although the ranges discussed below relate to the current legislated additional contribution rates of 2.0% and 8.0%, the absolute deviations from the legislated rates would remain constant if the legislated additional contribution rates were changed. The five ranges correspond to three categories of actions and are defined as follows:

-  Range C<sup>6</sup>: is a “No Action Required” range, where the FAMCR is within
  - For years 2024 to 2038: 1.70% to 2.20% (or 30 bps below to 20 bps above 2.0%), and the SAMCR is within a range corresponding to four times the magnitude, i.e. from 6.80% to 8.80% (120 bps below to 80 bps above 8.0%), and
  - For years 2039 and thereafter: 1.80% to 2.10% (or 20 bps below to 10 bps above 2.0%), and the SAMCR is within a range corresponding to four times the magnitude, i.e. from 7.20% to 8.40% (80 bps below to 40 bps above 8.0%).
-  Ranges B and D: are two “Warning” ranges falling immediately outside Range C. They are each 10 bps in length for the FAMCR (40 bps for the SAMCR). An AMCR falling in the same

<sup>5</sup> According to subsection 113(11.141) of the *Canada Pension Plan*, the legislated additional contribution rates are rates defined by Schedule 2 of the statute and do not take into account any deemed changes that result from the operation of the additional CPP Sustainability Regulations.

<sup>6</sup> This range is not defined explicitly in the Regulations.

Warning range for two consecutive valuations would require immediate action under the provisions of the Regulations.

- For a surplus situation, these ranges are described by subparagraphs 2(2)(a)(i) and 2(2)(b)(i) of the Regulations for the FAMCR and by subparagraphs 2(4)(a)(i) and 2(4)(b)(i) for the SAMCR.
- For a deficit situation, these ranges are described by subparagraphs 2(2)(a)(ii) and 2(2)(b)(ii) for the FAMCR, and by subparagraphs 2(4)(a)(ii) and 2(4)(b)(ii) for the SAMCR.

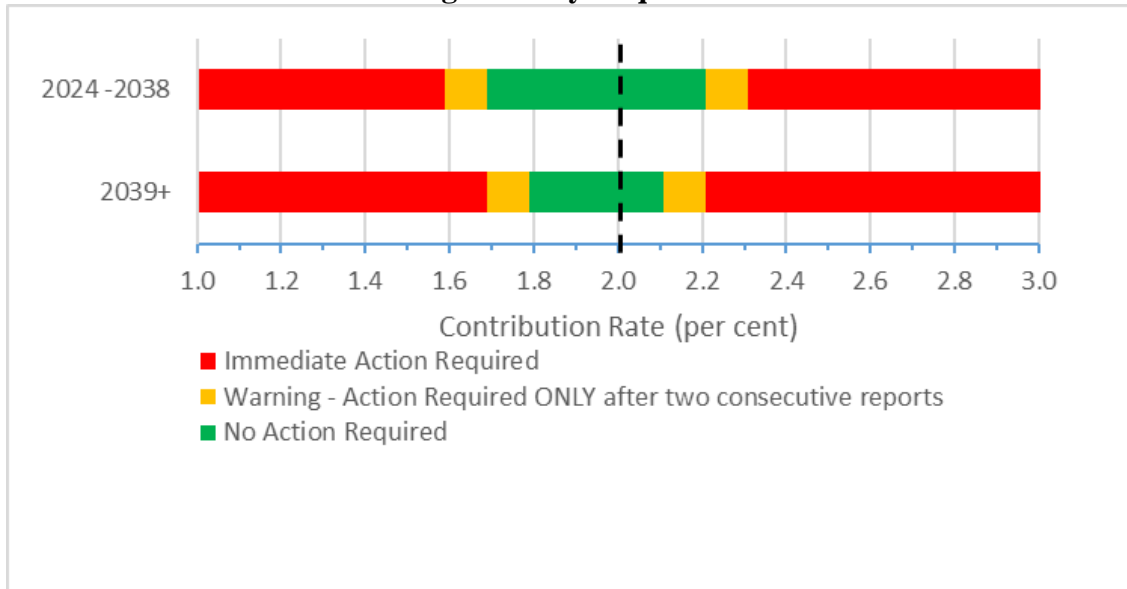
○ Ranges A and E: are two “Immediate Action Required” ranges that fall beyond the Warning ranges. They correspond respectively to

- For a surplus situation: an FAMCR at or below 1.59% for years 2024 to 2038 (subparagraph 2(1)(a)(i)) and at or below 1.69% for years 2039 and thereafter (subparagraph 2(1)(b)(i)). The corresponding ranges for the SAMCR are described by subparagraphs 2(3)(a)(i) and 2(3)(b)(i) (SAMCR at or below 6.36% for years 2024 to 2038 and at or below 6.76% for years 2039 and thereafter).
- For a deficit situation: an FAMCR at or above 2.31% for years 2024 to 2038 (subparagraph 2(1)(a)(ii)) and at or above 2.21% for years 2039 and thereafter (subparagraph 2(1)(b)(ii)). The corresponding ranges for the SAMCR are described by subparagraphs 2(3)(a)(ii) and 2(3)(b)(ii) (SAMCR at or above 9.24% for years 2024 to 2038 and at or above 8.84% for years 2039 and thereafter).

It should be noted that the second range will apply starting from the seventh triennial review (2037-2039). The action ranges of the AMCRs are graphically presented in Chart 5 and are summarized in Table 2. As shown, the ranges are categorized according to whether no action is required, action may be required in the case of a Warning, or is immediately required.



**Chart 5 Ranges of the FAMCR Relative to Current Legislated Rates  
 Categorized by Requirement of Action**



**Table 2 Ranges of AMCRs Relative to Current Legislated Additional Contribution Rates Categorized by Requirement of Action<sup>(1)</sup>**

Range	Requirement of Action	FAMCR	Difference 2.0% - FAMCR	SAMCR	Difference 8.0% - SAMCR
		(%)		(%)	

**Years 2024 to 2038**

<b>A</b>	Immediate Action Required	$\leq 1.59$	41 bps or higher	$\leq 6.36$	164 bps or higher
<b>B</b>	Warning – Action Required ONLY after being in this range for TWO consecutive reports	[1.60, 1.69]	31 to 40 bps	[6.40, 6.76]	124 to 160 bps
<b>C</b>	No Action Required	[1.70, 2.20]	-20 to 30 bps	[6.80, 8.80]	-80 to 120 bps
<b>D</b>	Warning – Action Required ONLY after being in this range for TWO consecutive reports	[2.21, 2.30]	-30 to -21 bps	[8.84, 9.20]	-120 to -84 bps
<b>E</b>	Immediate Action Required	$\geq 2.31$	-31 bps or lower	$\geq 9.24$	-124 bps or lower

**Years 2039 and thereafter**

<b>A</b>	Immediate Action Required	$\leq 1.69$	31 bps or higher	$\leq 6.76$	124 bps or higher
<b>B</b>	Warning – Action Required ONLY after being in this range for TWO consecutive reports	[1.70, 1.79]	21 to 30 bps	[6.80, 7.16]	84 to 120 bps
<b>C</b>	No Action Required	[1.80, 2.10]	-10 to 20 bps	[7.20, 8.40]	-40 to 80 bps
<b>D</b>	Warning – Action Required ONLY after being in this range for TWO consecutive reports	[2.11, 2.20]	-20 to -11 bps	[8.44, 8.80]	-80 to -44 bps
<b>E</b>	Immediate Action Required	$\geq 2.21$	-21 bps or lower	$\geq 8.84$	-84 bps or lower

- (1) Although the ranges shown in the table correspond specifically to the current legislated additional contribution rates of 2.0% and 8.0%, the absolute deviations from the legislated rates, shown in the Difference columns, would remain constant.
- (2) Warning Ranges: If the AMCRs under the previous actuarial report were in the:
- No Actions Required Range C, then wait for AMCRs of next report.
  - same Warning Range (B or D), then take immediate action.

The asymmetric nature of the “No Action Required” Ranges, with them being 10 bps wider on the side of surplus, is expected to minimize the risk of future reductions in benefits and/or increases in contribution rates because of future negative experience, as discussed later. Further, as also discussed later, this approach is aligned with the actions defined by the additional CPP Sustainability Regulations in the case of surplus.

The additional assets and benefit expenditures are relatively modest over the first couple of decades following the inception of the additional Plan. The importance of the additional assets and

corresponding investment earnings could be assessed using, for example, the evolution of the relative importance of the investment income and contributions as sources of revenues for the additional Plan. As shown in Table 18 of CPP29, it is projected that year 2039 is the first year when investment income and contributions are projected to be equal. After 2039, investment income becomes the main source of revenues for the additional Plan and its volatility has an important impact on the financial sustainability of the additional CPP. Therefore, the green “No Action Required” Range C is wider over the years 2024 to 2038 as compared to years 2039 and thereafter. As illustrated in the next subsection, this design is projected to be successful in minimizing the probability of required adjustments in the early years of the additional Plan without jeopardizing its financial sustainability.

As shown in the next subsection, for years 2039 and thereafter, the defined ranges are such that if the AMCRs are determined to be in the green “No Action Required” Range C, then there is approximately a 50 per cent chance that they will remain in that range. Having this range of “No Action Required” provides a degree of stability to the additional contribution rates and benefits paid without jeopardizing the financial sustainability of the additional Plan or creating any material intergenerational transfers. In particular, the need to preserve the financial sustainability of the additional CPP in combination with significant accumulated assets leads to the green “No Action Required” Range being narrower from 2039 onward compared to over the first two decades of the additional Plan’s existence.

In cases where the AMCRs fall within the amber “Warning” Ranges B or D, it is deemed less likely, but nonetheless still possible, that the rates could revert to the “No Action Required” Range C in the next triennial actuarial valuation. This probability though decreases with time, as illustrated in the next section. As such, subsection 113.1(11.141) of the Act requires that action should be taken only if the AMCRs fall within a given “Warning” range for two successive actuarial reports. Otherwise, if an AMCR moves from a “No Action Required” to a “Warning range”, then no action is needed immediately. This conditional action for the “Warning” ranges represents a compromise between maintaining the additional Plan’s provisions and, thus, the public’s perception of stability of the Plan and preserving the Plan’s financial sustainability.

In cases where the AMCRs fall in the red “Immediate Action Required” ranges, A or E, it is highly unlikely that the AMCRs would revert to values close to the legislated rates, i.e. fall back within the “No Action Required” Range C. The probability of such a reversion occurring falls as the difference between the AMCRs and legislated rates grows. Moreover, for the rates to revert to the Range C, the Canada Pension Plan Investment Board (CPPIB) would need to achieve significantly higher or lower results compared to the best-estimate assumption of CPP29, holding all other best-estimate assumptions equal (see next subsection). As such, if the AMCRs fall within Ranges A or E, immediate action would be required to bring them back either to the additional contribution rates in effect, in the case of Range E, or to the specified target values, in the case of Range A.

The following subsection discusses the probabilities of the AMCRs falling into any of the given ranges.

## **2. Impact of Investment Experience on Distributions of AMCRs and Application of Sustainability Provisions**

The AMCRs determined at any valuation date result from the actual demographic, economic, and investment experience of the additional CPP as well as the best-estimate assumptions and projections of the actuarial reports (with CPP28 being the first such report followed by CPP29). However, various variables affect the AMCRs to different extents as illustrated in the section on the Uncertainty of Results of CPP28 and section II.D of this actuarial study. One of the most important determinants of the AMCRs is the real rate of return on investments (i.e. the nominal rate of return net of inflation) and the resulting value of invested assets. All other variables, both with respect to experience and assumptions, have a much lower impact on the AMCRs.

The AMCRs are only marginally affected by fertility and migration (both the experience and assumptions). Mortality, in comparison, has a significant effect on the AMCRs, although the effect from one valuation to the next is not generally significant since both mortality experience and assumptions change gradually over time. In terms of economic variables, the real wage increase has an important impact on the AMCRs, although like mortality, the effect from one valuation to the next is dampened as changes in the real wage increase experience and assumptions occur gradually.

Given the importance of the investment experience, this section presents an analysis of the extent of its impact on the AMCRs, and provides illustrative probabilities of the AMCRs falling into different ranges. The impact of the investment experience on the AMCRs is assessed using stochastic analysis of the real rates of returns. For this analysis, 10,000 paths of returns were generated and, together with other assumptions described below, probability distributions of the resulting AMCRs were determined. The model used is based on the assumed asset allocation, real rates of return of each asset class, and volatility of those rates as used in CPP29. A detailed description of the model along with the resulting distributions of the real rates of return are provided in Appendix D.

It is important to note that the actual investment strategy and performance of the CPPIB could vary significantly from what is assumed in this study and thus could produce significantly different results. At the time of preparation of this study, based on the information presented in the CPPIB 2018 Annual Report, the additional assets allocation assumed for the purpose of CPP29 and this study is consistent with the CPPIB investment approach.

Although the investment experience is less important in the early years following the inception of the additional CPP due to the relatively low accumulated assets, as the assets accumulate over time the volatility of the AMCRs resulting from investment experience increases. The purpose of the stochastic analysis is to illustrate this volatility or range of AMCRs that could result from investment experience.

This section analyses the extent to which intervaluation investment experience (i.e. occurring between two or more consecutive valuations) affects the distribution of the AMCRs depending on the starting amount of assets (at the first of the valuations), the starting value of the AMCRs, and whether they are higher or lower than the legislated rates.

The AMCRs are determined according to the *Calculation of Contribution Rates Regulations, 2018*. In particular, the SAMCR is always four times the value of the FAMCR. As such, for simplicity, the

probability distributions presented pertain only to the FAMCR, where it is understood that the same probabilities would apply to the SAMCR, with ranges rescaled accordingly.

## **2.1 Investment Experience prior to 2039 (2022-2038)**

In this subsection, the projected impact of investment experience during the years 2022-2038, corresponding to the years of application of the first set of proposed ranges, is considered to illustrate that such impact will be limited due to there being relatively low accumulated assets. For this purpose, we consider the impact of investment experience on the AMCRs as determined by the actuarial valuation of the additional CPP as at 31 December 2021, that is, the first triennial valuation after the inception of the additional CPP. The following assumptions are made:

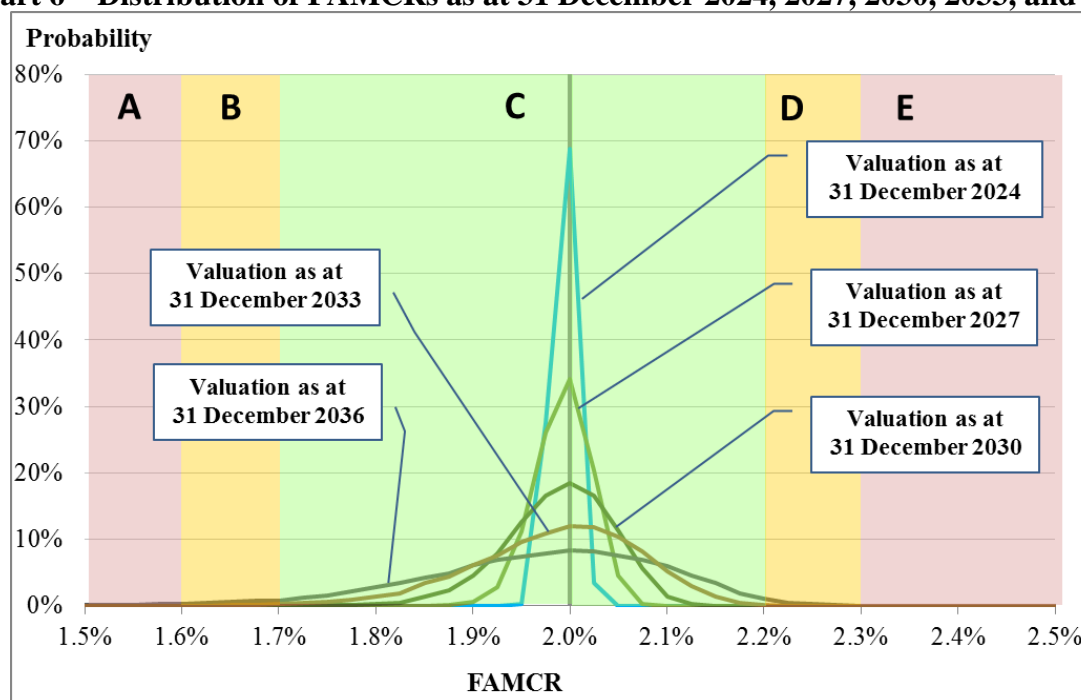
- The legislated contribution rates of 2.0% and 8.0% apply for all years 2024 and thereafter (with the 2.0% phased in over 2019-2023 as per the legislated schedule); that is, no deemed adjustments are made to the contribution rates due to changes in the AMCRs.
- All best-estimate assumptions of CPP29, including investment assumptions, are realized up to 31 December 2021.
- All best-estimate assumptions of CPP29 for years 2022 and thereafter are kept.

Given the above assumptions, the assets as at 31 December , 2021 would equal \$10.8 billion (see Table 18 of CPP29), and the FAMCR and SAMCR determined at that date would be 1.98% and 7.92% respectively (slightly lower than the legislated rates of 2.0% and 8.0%).

Using stochastic analysis, the investment experience is then simulated starting from the year 2022 for three, six, nine, twelve, and fifteen years up to, respectively, the next five valuation dates as at 31 December 2024, 2027, 2030, 2033, and 2036. The AMCRs are then determined at each valuation date, assuming that the legislated rates apply for the first three years after each valuation date and under the best-estimate assumptions of CPP29 for future years. The considered valuation dates cover the full period for which the wider No Action Required Range C (FAMCR within 1.70% and 2.20%) applies.

The results of the analysis in respect of the FAMCR are shown in Chart 6 and Table 3. Chart 6 shows the probability distribution of the FAMCR at the five considered valuation dates, and Table 3 presents the probabilities of the FAMCR falling within the specified ranges.

**Chart 6 Distribution of FAMCRs as at 31 December 2024, 2027, 2030, 2033, and 2036**



Note: The letters A to E in the chart refer to the FAMCR ranges described in Table 2.

**Table 3 Probabilities of FAMCR Being within Specified Ranges for Next Five Valuations after 31 December 2021<sup>(1), (2)</sup>**

Range	Probability of FAMCR being within a Range <sup>(1)</sup>				
	Valuation as at				
	31/12/2024	31/12/2027	31/12/2030	31/12/2033	31/12/2036
<b>A</b> ≤ 1.59%	0%	0%	0%	0%	1%
<b>B</b> 1.60% to 1.69%	0%	0%	0%	1%	2%
<b>C</b> 1.70% to 2.20%	100%	100%	100%	99%	96%
<b>D</b> 2.21% to 2.30%	0%	0%	0%	0%	1%
<b>E</b> ≥ 2.31%	0%	0%	0%	0%	0%

(1) Projected values of FAMCR and SAMCR as at 31 December 2021 are 1.98% and 7.92%.

(2) The same probabilities shown apply to the SAMCR, where the Ranges A to E are specified in terms of the SAMCR as shown in Table 2.

Chart 6 and Table 3 show that due to the relatively low assets over the first two decades of the additional CPP and the fact that the starting AMCRs as at 31 December 2021 are slightly lower than the legislated rates, there is a negligible to zero probability that the AMCRs will fall outside the No Action Required Range C.

As shown in Table 3, the probability of the FAMCR being within 1.70% and 2.20% (i.e. within -30 bps to +20 bps of the legislated rate of 2.0%) and so requiring no action falls only slightly over time, from 100% at the end of 2024, 2027, and 2030 to 99% at the end of 2033. As the additional assets accumulate, this probability decreases further to 96% at the end of 2036. Correspondingly, as the period of time increases during which the AMCRs are less than the legislated rates and the

accumulated assets grow, there is a small probability of the FAMCR falling between 1.60% and 1.69% (Warning Range B). However, given that the FAMCR must fall substantially to be in Range B and that the additional Plan is still in its early years by 2033, the probability of the AMCRs falling in Range B only reaches 1% by the end of 2033 and 2% by the end of 2036. By the end of 2036 there is a small 1% probability that the FAMCR is situated in the red Immediate Action Required Range A. Finally, by the end of 2036 there is a small 1% probability that the FAMCR will be higher than 2.20% and will fall in the Warning Range D.

Therefore, the analysis indicates that, in the early years following inception, there is a very low probability that adjustments will be needed to restore the financial sustainability of the additional CPP.

## **2.2 Medium Term Investment Experience (2043-2048)**

Over the medium term, as the size of assets becomes more important, the impact of investment experience on the AMCRs will become more pronounced both in terms of the actual values of the AMCRs and the degree of variability in these values. This section considers the impact of the investment experience following the valuation as at 31 December 2042. The following assumptions are made:

- The legislated contributions rates of 2.0% and 8.0% apply for all years 2024 and thereafter (with the 2.0% phased in over 2019-2023 as per the legislated schedule); that is, no deemed adjustments are made to the contribution rates due to changes in the AMCRs.
- All best-estimate assumptions of CPP29, including investment assumptions, are realized up to 31 December 2042. This means that, in particular, the AMCRs are slightly lower than the legislated additional contribution rates for the entire period 2019 to 2042. Given the above assumptions, the assets as at 31 December 2042 would equal \$730.3 billion (see Table 18 of CPP29), and the FAMCR and SAMCR determined at that date would be 1.95% and 7.80% respectively (lower than the legislated rates of 2.0% and 8.0%).
- Seven investment return paths, ranging from strong to weak investment performance, were considered for the years 2043 to 2045. These investment paths resulted in the average three-year nominal rates of return of 13.9%, 10.8%, 7.3%, 3.0%, -0.5%, -5.2%, -9.8%. Based on the modelled rate of return distributions and the best-estimate assumptions of CPP29, the probabilities that the average nominal returns over three years will exceed the chosen ones are 6%, 17%, 39%, 70%, 88%, 98% and 99.8%, respectively.
- All best-estimate assumptions of CPP29 as at 31 December 2042 for years thereafter are kept, except for the investment rate of return which varies only for 2043 to 2045.

Table 4 shows the resulting average nominal rates of return, projected assets, and FAMCRs as at 31 December 2045. As shown, the projected assets decrease and the FAMCR increases with assumed lower investment return experience. For comparison, the projected assets under CPP29 are \$927.6 billion as at 31 December 2045 (under the legislated additional contribution rates).

**Table 4 Projected Average Nominal Rates of Return, Assets, and FAMCRs  
 Determined as at 31 December 2045**

	Investment Scenario						
	1	2	3	4	5	6	7
<b>Average nominal rate of return 2019-42<sup>(1)</sup></b>	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%	5.4%
<b>Average nominal rate of return 2043-45<sup>(1)</sup></b>	13.9%	10.8%	7.3%	3.0%	-0.5%	-5.2%	-9.8%
<b>Average nominal rate of return 2019-45<sup>(1)</sup></b>	<b>6.3%</b>	<b>6.0%</b>	<b>5.6%</b>	<b>5.1%</b>	<b>4.7%</b>	<b>4.2%</b>	<b>3.6%</b>
<b>Projected assets under legislated additional contribution rates<sup>(2)</sup> (\$ billion)</b>	1,154.7	1,068.1	969.8	863.6	777.4	676.9	590.8
<b>FAMCR<sup>(3)</sup></b>	<b>1.71%</b>	<b>1.80%</b>	<b>1.90%</b>	<b>2.01%</b>	<b>2.10%</b>	<b>2.20%</b>	<b>2.29%</b>

(1) CPP29 nominal rate of return best-estimate assumptions for 2019-2042, simulated paths for 2043-2045.

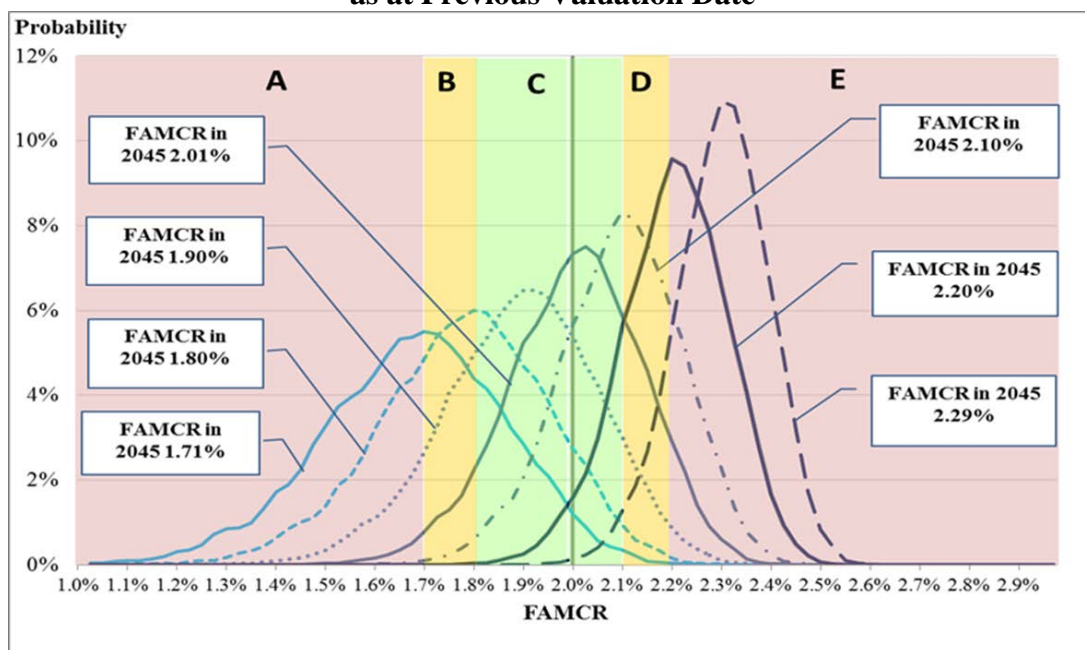
(2) The projected assets under CPP29 are \$927.6 billion as at 31 December 2045 (under the legislated additional contribution rates).

(3) FAMCRs based on investment scenarios and projected assets as at 31 December 2045 and best-estimate assumptions of CPP29 for all years thereafter.

Next, for each of the seven scenarios above, 10,000 simulations of the investment experience are run for the next three intervalation years 2046 to 2048, and the probability distributions of the resulting FAMCRs at 31 December 2048 are obtained, given their previous values three years earlier. All scenarios assume that contributions are paid under the additional contribution rates of 2.0% and 8.0%. Chart 7 illustrates different distributions of the FAMCRs determined as at 31 December 2048, and Table 5 presents the probabilities that the FAMCRs determined at that date fall within the specified ranges.



**Chart 7 Distribution of FAMCRs as at 31 December 2048 Given Different FAMCRs as at Previous Valuation Date**



*Note: The letters A to E in the chart refer to the FAMCR ranges described in Table 3.*

**Table 5 Probabilities of FAMCR Being within Specified Ranges as at 31 December 2048 Given Different Values at Previous Valuation Date**

Range		FAMCRs as at 31 December 2045						
		1.71%	1.80%	1.90%	2.01%	2.10%	2.20%	2.29%
		Probability as at 31 December 2048 of FAMCRs being within a Range						
A	≤ 1.69%	52%	32%	13%	3%	0%	0%	0%
B	1.70% to 1.79%	20%	21%	16%	6%	2%	0%	0%
C	1.80% to 2.10%	27%	44%	61%	65%	47%	18%	3%
D	2.11% to 2.20%	1%	3%	7%	17%	28%	28%	13%
E	≥ 2.21%	0%	0%	2%	9%	23%	54%	84%

Several observations can be made from Chart 7 and Table 5. As the starting FAMCR (as at 31 December 2045) increases, the distribution of the range of FAMCR values as at the following valuation narrows, that is, the standard deviation decreases (shown by the narrowing of the curves in Chart 7). The reason is that the lower starting FAMCRs had resulted from higher accumulated assets (due to better investment experience up to 2045), and starting from higher assets leads to a greater range of possible FAMCRs at the next valuation compared to starting with lower assets (and higher FAMCRs).

For the starting FAMCRs in 2045 within Range C of 1.80% to 2.10% (i.e., 1.80%, 1.90%, 2.01%, 2.10%) there is between a 44% to 65% probability that the subsequent FAMCRs in 2048 remain in the same range. For these scenarios, the probability of the FAMCR in 2048 falling in a Warning Range B or D is between 23% (16% + 7%) and 30% (2% + 28%). The probability of the FAMCR in 2048 being lower than 1.70% or above 2.20% (i.e. in Range A or E) is between 12% (3% + 9%) and 32%.

For the starting FAMCRs in 2045 within range A or E (below 1.70% or above 2.20%), the chance of reverting to values close to the legislated rate of 2.0% by 2048 is quite small: only 3% for the starting FAMCR of 2.29%. Once an FAMCR is within range A or E, there is a high probability that it will remain within those ranges, unless corrective action is taken.

For the starting FAMCRs that are within the intermediate Warning Ranges B or D (i.e. 1.71% and 2.20%) there is an 18% to 27% chance that the rates will revert to ones closer to 2.0%. As such, there is also the same range of probability that the financial sustainability provisions would not be invoked.

Lastly, it is important to note that the chance of the AMCRs reverting to rates closer to the legislated ones reduces with each subsequent valuation, assuming no change is made to the additional CPP provisions and the best-estimate assumptions are realized. This is especially true for situations when AMCRs are within Ranges A or E and to a lesser degree when these rates are within Ranges B or D. That is, assuming all else equal, once the AMCRs diverge from the legislated rates, the divergence will tend to grow over time as the probability of staying within a given range falls and the probability of moving into a range further from the legislated rates increases.

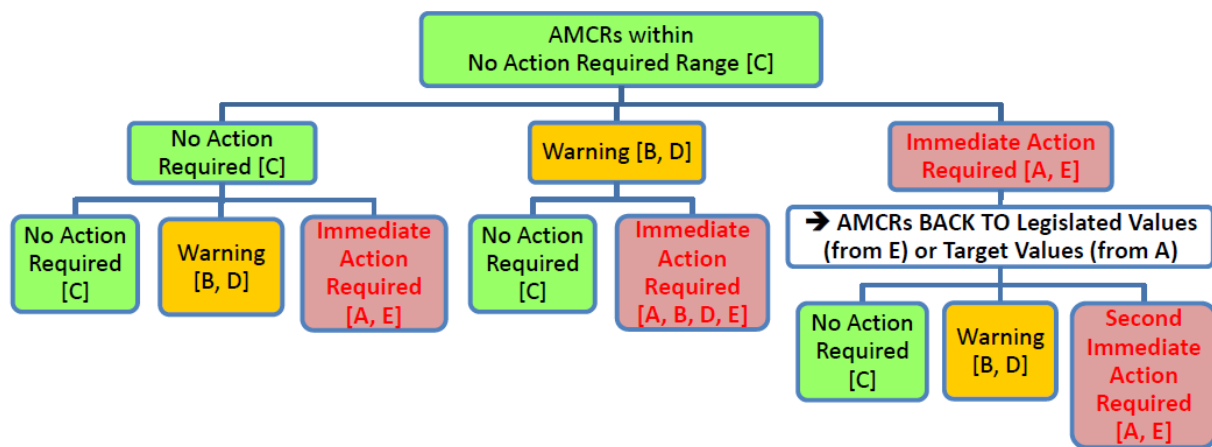
Changes to the additional CPP provisions and/or significantly different experience developing from that assumed would be required for the AMCRs to revert to their respective legislated rates. For instance, for the FAMCR of 2.29% in 2045 to revert to 2.0% in 2048 would require an average nominal rate of return of 19.9% over the three years 2046 to 2048, which is 14.3 percentage points higher than the best-estimate assumption of 5.63% under CPP29. Based on the modelled rates of return distribution, there is almost no chance for nominal returns for 2046-2048 to be equal or higher than 19.9%. At the other end, the FAMCR of 1.71% in 2045 would revert to 2.0% in 2048 if the interim average nominal rate of return were -3.5%, or 9.1 percentage points lower than that assumed under CPP29. Based on the modelled rates of return distribution, there is about 4% chance for nominal returns for 2046-2048 to be equal or lower than -3.5%.

### **2.3 Illustrations: Requirement to Take Action under Additional CPP Sustainability Regulations over Two Valuation Cycles**

The following three flowcharts illustrate possible outcomes of when action would be required under the additional CPP Sustainability Regulations over two valuation cycles (three valuations in total). The three flowcharts represent the three different possibilities that could arise based on the values of the initial AMCRs determined at the first of the three valuations, namely AMCRs starting within the No Action Required Range C, the Warning Ranges B or D, or the Immediate Action Required Ranges A or E. The probabilities of the AMCRs falling within any of these ranges would be similar to those shown in Table 5.

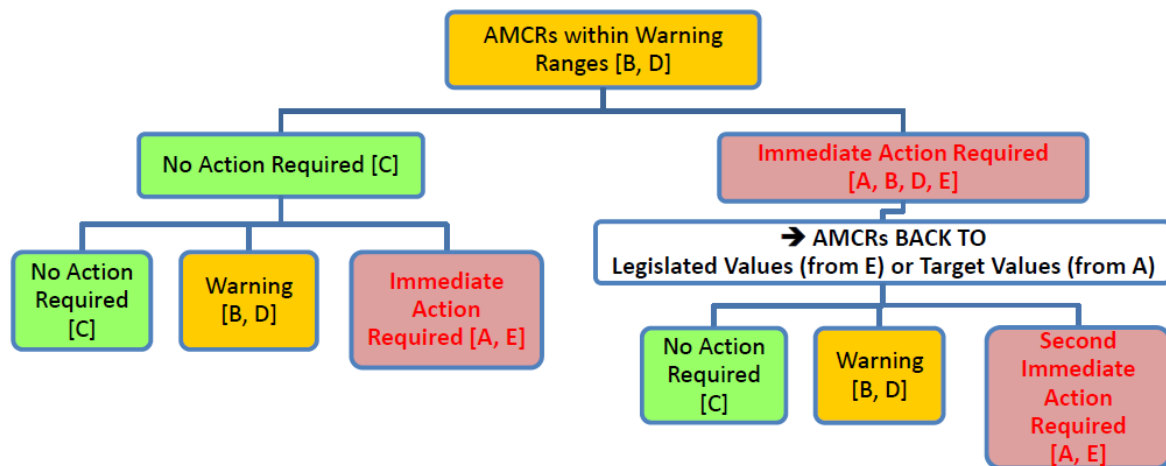
## Example 1

In this example, the AMCRs start within the No Action Required Range C. At the time of the second valuation, the AMCRs may still fall within Range C and thus require no action, or may fall within the Warning Ranges (B, D) or Immediate Action Required Ranges (A, E). If the AMCRs are within the Immediate Action Required Ranges, then actions would be taken under the provisions to bring the AMCRs back to the legislated (or target) values, thus placing the AMCRs in Range C. Immediate action may be required at the time of the third valuation. In particular, if the AMCRs remain in a Warning Range for two consecutive valuations, then immediate action would be required. As previously noted, the greater the divergence of the AMCR from their legislated rates, the higher probability that an AMCRs will diverge further from the legislated rates over time and move into another range further from Range C.



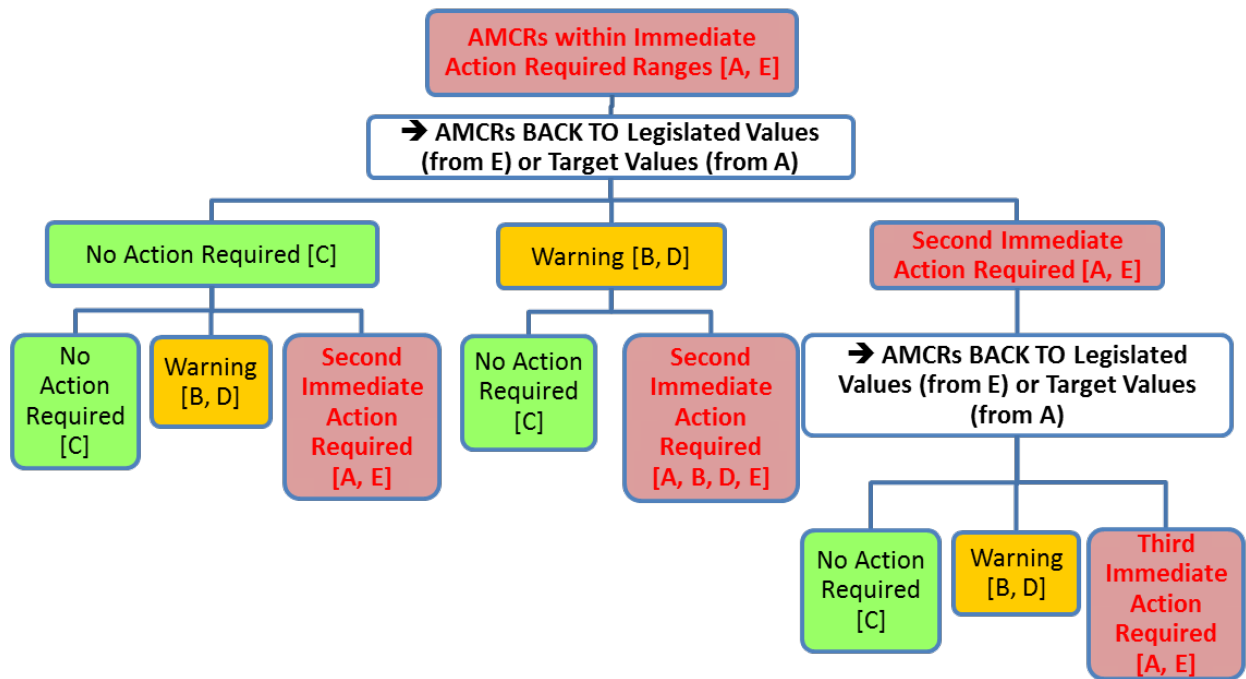
## Example 2

In this example, the AMCRs start within a Warning Range (B or D). In this case, at the time of the second valuation, the AMCRs may require no action if they revert closer to the legislated rates and thus fall in Range C, or they may require immediate action if they remain in the same Warning Range or move further into an Immediate Action Required Range (A, B, D, or E). As for the previous example, once immediate action is required, the AMCRs are brought back to the legislated or target values (in Range C).



### Example 3

In this last example, the AMCRs start in an Immediate Action Required Range (A or E) and, as such, are brought back to the legislated values from Range E or target values from Range A. The resulting possible ranges of the AMCRs at the second and third valuations are then the same as shown in Example 1.



## **D. Required Actions**

### **1. Introduction**

The previous section discussed the circumstances when actions would be required to restore the AMCRs to their respective legislated or target rates in accordance with the additional CPP Sustainability Regulations. This section discusses such actions.

As pointed out earlier, there are several reasons why the automatic adjustment provisions differ between the base and additional CPP, including the differences in design between the two plans, the different financing approaches, and the different ways in which intergenerational equity is addressed. Unlike the base CPP, the automatic adjustments for the additional CPP are not intended to be permanent, but rather allow for possible reversals at a later time.

The defined ranges and the actions to be taken are aimed at achieving the goals of preserving the financial sustainability of the additional CPP (i.e. preventing both substantial underfunding and overfunding), ensuring stability of the contribution rates, and reducing the risk of reduction in benefits and/or increases in the contribution rates.

It is worth repeating that the additional CPP Sustainability Regulations are a default mechanism that would apply only if the AMCRs differ significantly from the legislated rates and the federal and provincial Finance Ministers did not reach agreement on whether any changes to the Plan's parameters were required. In other words, even if the AMCRs fall into a range where immediate actions would be required by the additional CPP Sustainability Regulations, such requirements could be overridden by decisions taken by the Finance Ministers.

The following sections discuss actions in the case where the AMCRs fall into an "Immediate Action Required" range or fall two valuations in a row into a "Warning" range, explain how benefits for current and future participants are adjusted, present the estimated financial impacts resulting from the application of the additional CPP Sustainability Regulations, and show the impacts on contributors and beneficiaries. All mentions of "review period" refer to the three-year financial review period corresponding to the most recently determined AMCRs. It should be noted that actions defined by the additional CPP Sustainability Regulations are different in surplus and deficit situations.

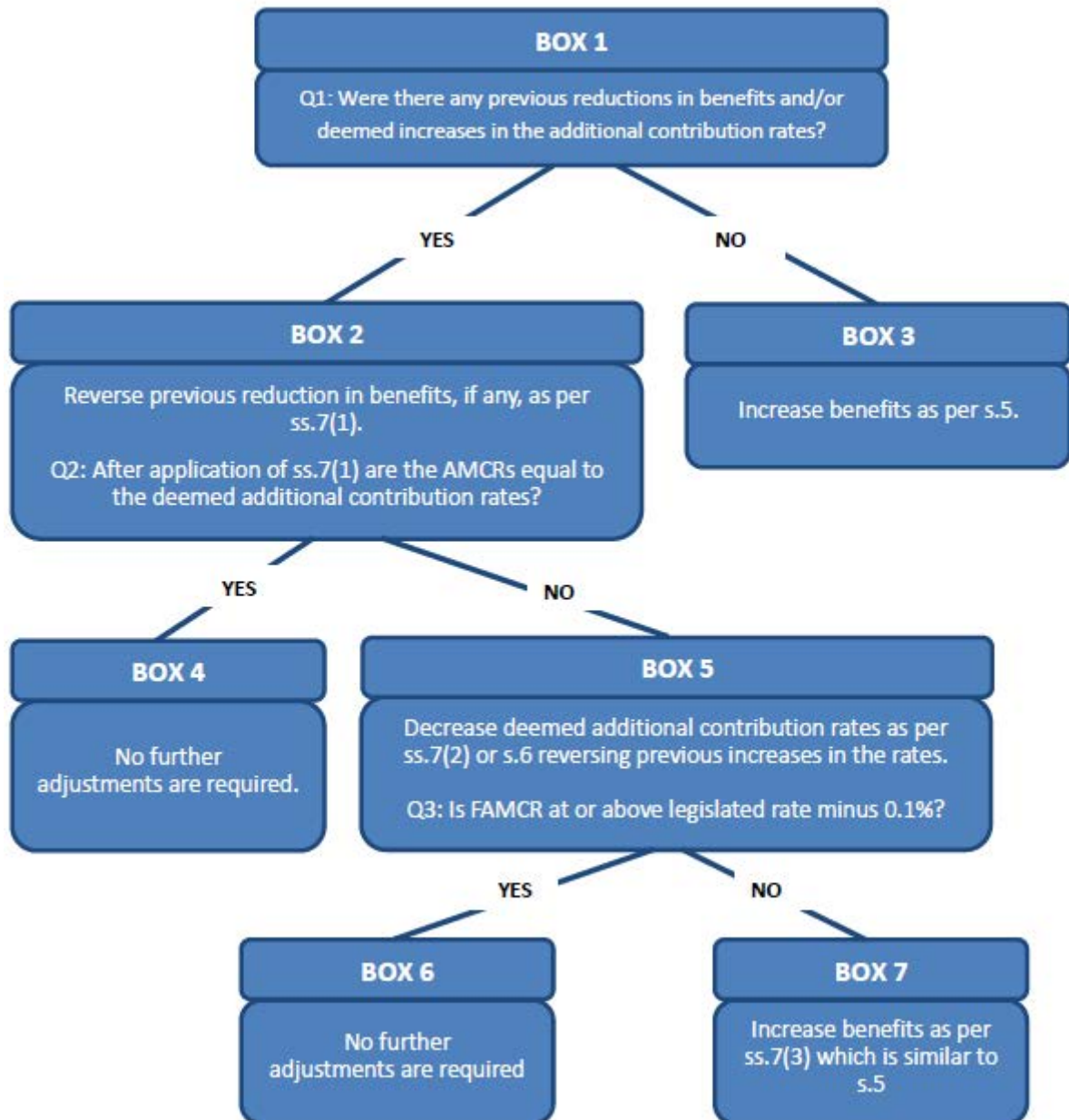
Unless mentioned specifically, this study considers situations where the temporary contribution rates defined under paragraph 113.1(4)(e) of the Act in respect to additional benefits are equal to zero. Appendix E explains how the additional CPP Sustainability Regulations are applied in case these temporary rates are not equal to zero.

Finally, as mentioned earlier, actions of the additional CPP Sustainability Regulations that increase/decrease additional contribution rates do not result in a change in the legislated rates as defined by Schedule 2 of the Act. Therefore, contribution rates defined by Schedule 2 are referred to as the "legislated rates", and contributions rates resulting from the application of the Regulations are referred to as "deemed contribution rates".

## 2. Actions in Surplus Position

The surplus position corresponds to the situation where the AMCRs are lower than the legislated contribution rates and fall in Range A or two consecutive times in Range B. Chart 8 presents a decision tree associated with actions for the surplus position.

**Chart 8 Application of Additional CPP Sustainability Regulations When in Surplus<sup>7</sup>**



<sup>7</sup> All references to sections and subsections are in respect to the additional CPP Sustainability Regulations.

The first question to be asked is whether any previous reductions in benefits and/or deemed increases in contribution rates have occurred in the past as a result of the operation of the additional CPP Sustainability Regulations, and whether these actions have been reversed. Subsections 2.a and 2.b address the situations where the answer to this question is negative or positive, respectively.

***2.a. Case where there were no previous reductions in benefits and/or deemed increases in contribution rates as a result of the operation of the additional CPP Sustainability Regulations (section 5 of the additional CPP Sustainability Regulations)***

If the answer to the question in Box 1 is “No” (i.e. the benefits in pay are equal to the legislated benefits and the contribution rates are the same as specified in Schedule 2 of the *Canada Pension Plan*), the benefits of current and future beneficiaries are adjusted upward as follows.

The benefits in pay are adjusted by increasing indexation for a minimum of six years following the end of the review period, with resumption to regular indexation thereafter, and benefit multipliers higher than 1 are applied to new benefits for all beneficiaries who start their benefit after the end of the review period.

The modification of the indexation of benefits in pay and the application of benefit multipliers to new benefits should satisfy the following four conditions:

Condition 1: *The resulting FAMCR and SAMCR should be equal to the first additional legislated rate minus 10 bps and the second additional legislated rate minus 40 bps, respectively.*

In other words, the AMCRs are increased to target values that are lower than the legislated contribution rates. Under the current legislated additional contribution rates of 2% and 8%, these target values are 1.9% and 7.6% for the FAMCR and SAMCR, respectively.

Condition 2: *The increase in indexation of benefits in pay cannot exceed changes in the Consumer Price Index (CPI).*

As such, the maximum total indexation of benefits in pay is equal to twice the cumulative value of inflation over the six years.

Condition 3: *After the end of the adjusted indexation period, the percentage increase in benefits in pay should be equal or nearly equal to the percentage increase in future new benefits.*

In particular, this means that the benefit multipliers for new benefits emerging during the adjusted indexation period of benefits in pay are determined in such a way as to not over-reward new beneficiaries who start their benefit during that period.

Condition 4: *The number of years over which indexation of benefits in pay is adjusted should be increased from the minimum of six years by multiples of three years (i.e., 9, 12, 15,...) and the indexation adjusted as needed.*



Using different lengths for an adjustment period may be required to ensure that the impact of changes in benefits bring the AMCRs to their target values.

***2.b. Case where there were previous reductions in benefits and/or deemed increases in contribution rates as a result of operation of the additional CPP Sustainability Regulations (sections 6 and 7 of the additional CPP Sustainability Regulations)***

If the answer to the question in Box 1 is “yes”, i.e. there were previous reductions in benefits and/or deemed increases in the contribution rates, then the first step will be to reverse the previous decreases in benefits and, after that, to reverse the previous increases in the contribution rates. In other words, actions defined by the additional CPP Sustainability Regulations aim at bringing benefits and contribution rates back to the original legislated levels.

The accumulation of any previous reductions in benefits is reversed to the extent that the impact of such reversal on the AMCRs does not exceed the absolute differences between the AMCRs and the deemed additional contribution rates<sup>8</sup>.

Specifically, the reversal of previous reductions in benefits in pay and new benefits is done through an increase in benefit indexation and gradual phasing out of benefit multipliers, respectively following the end of the review period (action of Box 2 of Chart 8).

The full or partial reversal of previous reductions in benefits may be sufficient to align the AMCRs with the deemed contribution rates (answer “yes” to question 2 in Box 2). In this case, the additional CPP Sustainability Regulations do not require any future actions.

However, if the previous reductions in benefits are fully reversed but the AMCRs are still lower than the deemed additional contribution rates (answer “no” to question 2 in Box 2) and there were previous deemed increases in the additional contribution rates, these increases can now be fully or partially reversed.

The previous deemed increases in the additional contribution rates are reversed to the extent that the resulting additional contribution rates are not lower than the greater of the AMCRs and the legislated contribution rates (actions of Box 5).

The final step corresponds to the situation where after the full reversal of all reductions in benefits and deemed increases in contribution rates, the AMCRs still remain below their target values (answer “yes” to question 3 in Box 5). In this case, additional increases in benefits, as discussed in subsection 2.a, are required.

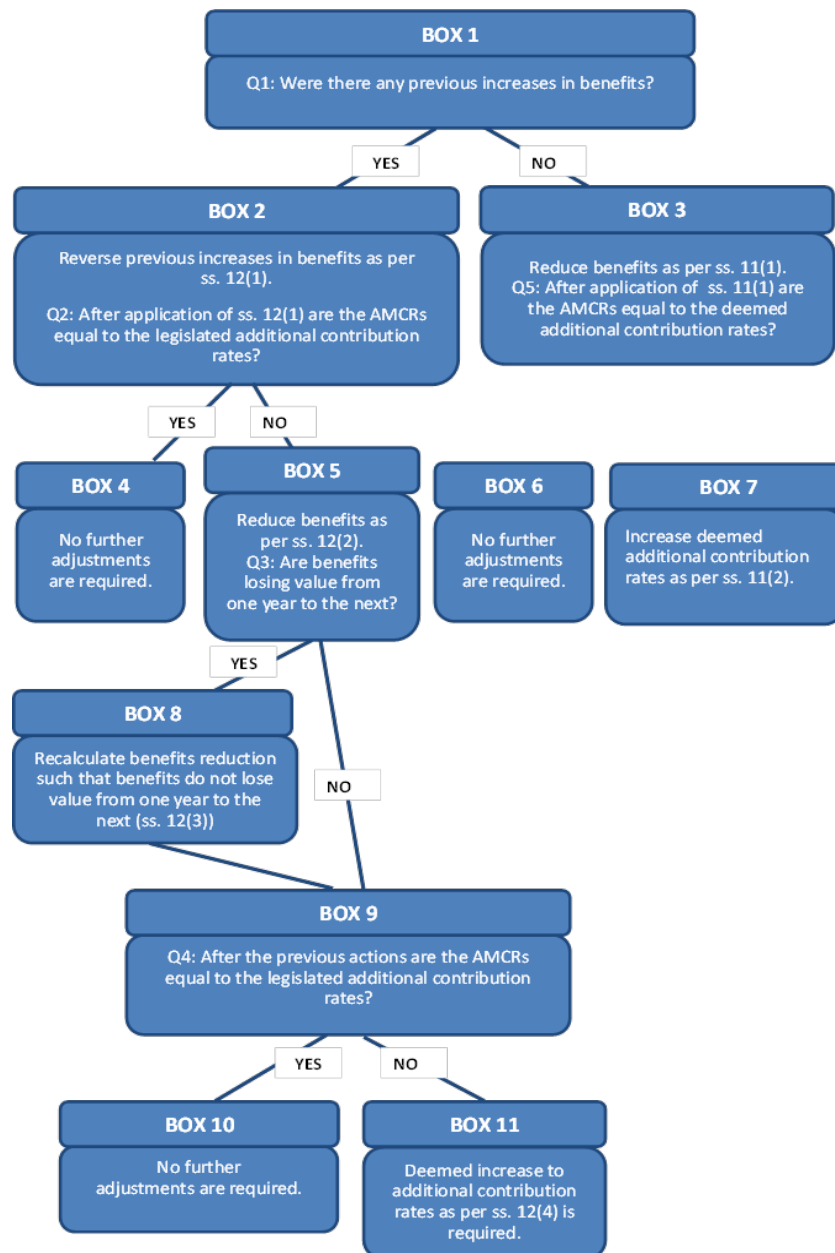
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<sup>8</sup> It should be noted that as a result of a previous application of the additional CPP Sustainability Regulations, the deemed additional contribution rates used to determine contributions to be paid by employees, employers and self-employed may be higher than the rates defined in Schedule 2 of the Act.

### 3. Actions in Deficit Position

The deficit position corresponds to the situation where the AMCRs are higher than the legislated contribution rates and fall in Range E or two consecutive times in Range D. Chart 9 presents a decision tree associated with actions in the deficit positions.

**Chart 9 Application of Additional CPP Sustainability Regulations When in Deficit<sup>9</sup>**



<sup>9</sup> All references to sections and subsections are in respect to the additional CPP Sustainability Regulations.

Similar to the surplus situation, the first question to be asked is whether there were any previous increases in benefits in the past because of the operation of the additional CPP Sustainability Regulations and whether these actions have been fully reversed. Subsections 3.a and 3.b address the situations where the answer to this question is negative or positive, respectively.

**3.a. *Case where there were no previous increases in benefits as a result of the operation of the additional CPP Sustainability Regulations (section 11 of the additional CPP Sustainability Regulations)***

If the answer to question 1 in Box 1 is “No” (i.e. the benefits in pay are equal to the legislated ones), then the benefits of current and future beneficiaries are adjusted downward as follows.

The benefits in pay are adjusted by reducing indexation for six years following the end of the review period, with resumption to regular indexation thereafter, and benefit multipliers lower than 1 are applied to new benefits for all beneficiaries who start their benefit after the end of the review period. It should be noted that unlike the surplus situation, the period of downward benefit adjustment for benefits in pay is fixed at six years.

The modification of the indexation of benefits in pay and the application of benefit multipliers to new benefits should satisfy the following three conditions:

Condition 1: *The resulting AMCRs should be as close as possible but not lower than the legislated contribution rates defined by Schedule 2 of the Act.*

In other words, the goal is to align the AMCRs to their legislated contribution rates.

Condition 2: *The indexation of benefits in pay should not be less than 60% of the change in the CPI.*

As such, the maximum total reduction in the growth of benefits in pay over the six years following the end of a review period is equal to the cumulative value of partially foregone inflation protection over those years; that is, reduced indexation would be applied.

Condition 3: *After the end of the adjusted indexation period, the percentage decrease in benefits in pay should be equal or nearly equal to the percentage decrease in future new benefits.*

In particular, this means that the benefit multipliers for new benefits emerging during the adjusted indexation period of benefits in pay are determined in such a way as to not over-penalize new beneficiaries who start their benefit during that period.

Imposing a restriction on the length of the adjustment period (six years following the end of the triennial review) and on the magnitude of the adjustment (Condition 2) may result in a situation where the reductions in benefits are not sufficient to align the AMCRs with the contribution rates (answer of “No” to Question 5 in Box 3). In that case, deemed increases in the additional contribution rates are required (actions of Box 7)).

**3.b. *Case where there were previous increases in benefits as a result of operation of the additional CPP Sustainability Regulations (section 12 of the additional CPP Sustainability Regulations)***

If the answer to question 1 in Box 1 of Chart 9 is “Yes”, i.e. there were previous increases in benefits, then, first, these previous increases need to be reversed. In other words, the actions defined by the additional CPP Sustainability Regulations aim at bringing benefits back to their original legislated levels.

The accumulation of any previous increases in benefits is reversed to the extent that the impact of such reversals on the AMCRs does not exceed the absolute differences between the AMCRs and the respective legislated additional contribution rates.

Specifically, the reversal of previous increases of benefits in pay and new benefits is done through an adjustment in benefit indexation and benefit multipliers, respectively, and is phased out following the end of the review period (action of Box 2 of Chart 9).

The full or partial reversal of previous increases in benefits may be sufficient to align the AMCRs with the legislated contribution rates (answer “Yes” to question 2 in Box 2). In this case, the Regulations do not require any future actions.

However, if the previous increases in benefits are fully reversed but the AMCRs are still higher than the legislated additional contribution rates (answer “No” to question 2 in Box 2) then an additional decrease in benefits and/or deemed increase in contribution rates as per subsection 3.a are required.

Due to the constraint that the benefits in pay cannot be reduced from one year to another, the additional CPP Sustainability Regulations (subsection 12(3)) ensures that the total reduction in indexation resulting from the reversal of previous increases in benefits and the current decreases doesn’t exceed 100%.

## **4. Discussion**

The additional CPP Sustainability Regulations prescribe adjustments for situations when the AMCRs are determined to be either “too high” or “too low”. In line with the goals of the sustainability provisions<sup>10</sup> and the way the triggers (action ranges) of these provisions are defined, the actions applied in a surplus position are different from those applied in a deficit position.

Each set of actions defined in the Regulations has its own goal. The actions prescribed under section 6 and subsections 7(1), 7(2) and 12(1) of the Regulations partly or fully restore the additional benefits and additional contribution rates to their legislated levels with the priority given to benefits. In general, an individual during his/her working years could see several adjustments (possibly mutually cancelling) before commencing his/her own benefit.

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<sup>10</sup> These goals were formulated in subsection III.B of the study as preserving the financial sustainability of the additional CPP (i.e. preventing both substantial underfunding and overfunding), ensuring stability of the additional contribution rates, and mitigating the risk of reduction in benefits and/or increases in the contribution rates.

The actions of sections 5 and 11 and subsections 7(3) and 12(2)-12(4) apportion the impacts of adjustments between current and future beneficiaries. Moreover, in cases where contribution rates are deemed to be increased through the operation of subsections 11(2) and 12(4), employers would be affected as well.

The consecutive application of decreases in benefits and deemed increases in additional contribution rates aims at mitigating the frequency of the change in the contribution rates. That is, the initial actions are always focused on benefit adjustments of current and future beneficiaries.

Condition 3 as described by subsections 2.a and 3.a is very important since it defines how the adjustment is to be shared between current and future beneficiaries before any change in the contribution rates is enacted. As discussed in section III.B, the additional Plan is complex and designed to cover multiple cohorts at the same time. In addition, definitions of intergenerational equity could be ambiguous, technically complex, and difficult to explain. The adopted principles provide a straightforward approximation of intergenerational equity by applying the same percentage increase or decrease to benefit amounts of current beneficiaries as to the amounts of new benefits. This approach is actuarially appropriate, easy to understand, easy to explain, and will most likely be perceived as “fair” by different generations. More discussion on the resulting internal rates of return for affected participants is provided below (subsection III.C.7 of this study).

The extent to which only benefits are adjusted, with the contribution rates remaining unchanged, is a balance between, on the one hand, the desire to maintain stable legislated contribution rates, and, on the other hand, the desire to limit the impact of adjustments on current retirees and include employers in cost sharing in the case of negative experience for the additional Plan.

By not allowing the indexation of benefits in pay to be less than 60% of the change in the CPI, the Regulations set dynamic limits on the impacts that reductions in benefits would have on the AMCRs. As the additional Plan matures and the number of beneficiaries and the size of their benefits increase, the impact on the AMCRs will increase as well. As described later in subsection III.C.6, in the short to medium term, reducing indexation to 60% of the changes in the CPI for current beneficiaries and applying corresponding benefit multipliers for new beneficiaries reduce the FAMCR by about 10 to 14 bps (40 to 56 bps for the SAMCR). By the 2080s, these impacts are projected to increase to about 17 bps and 68 bps for the FAMCR and SAMCR, respectively.

In addition, as the number of beneficiaries increases, this subpopulation will eventually bear an increasingly higher share of adjustment relative to contributors and employers. However, it should be noted that even at maturity the impact of benefit multipliers on the AMCRs will always be higher than the impact of the corresponding reduction in indexation. This is a direct result of the relative number of plan participants affected by each measure: a reduction in indexation only affects current beneficiaries, while the benefit multipliers affect current and future contributors – a much larger group.

In the medium and long terms and in a deficit position, if the AMCRs fall into the Immediate Action Required Range, then both benefits and contribution rates would likely need to be adjusted. If the AMCRs fall twice in the Warning Range D, there will be situations where only adjustments to benefits are applied and situations where both benefits and contribution rates are adjusted.

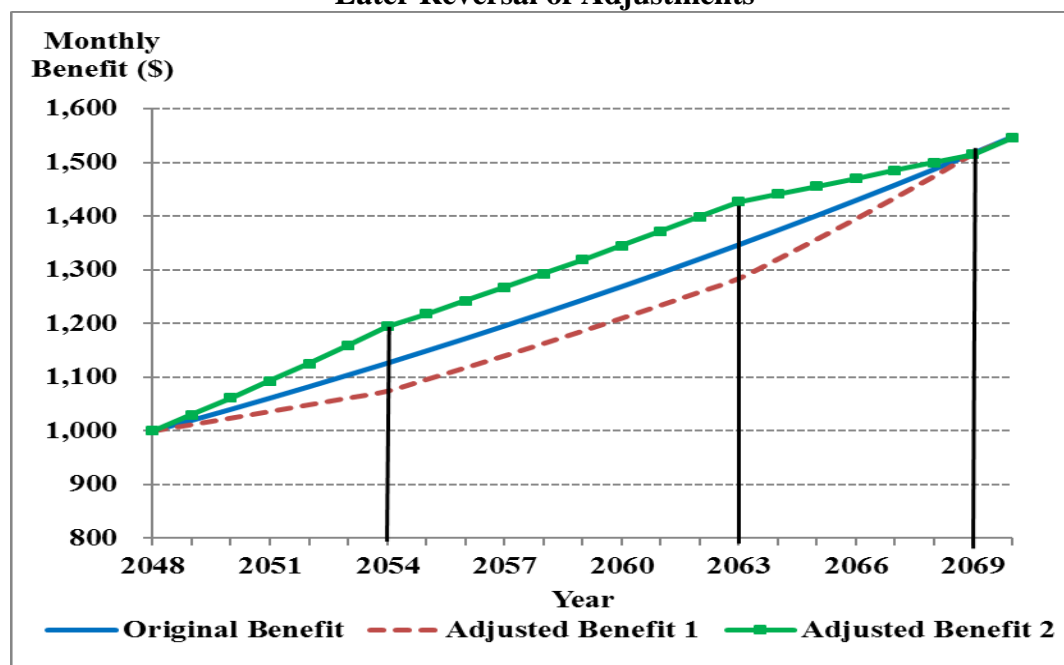
The actions in the case of surplus (the case where the AMCRs are below the legislated rates) focus on adjustments to benefits only. It should be noted that these actions will be required only in the case when both previous reductions in benefits and deemed increases in contribution rates are reversed. Thus, no future improvements in benefits are granted to participants before the burden of increased contributions is reversed both for contributors and for employers. To minimize the risk of a future reduction in benefits and increase in contribution rates, the additional CPP Sustainability Regulations stipulate that improvements granted to existing and future beneficiaries do not bring the AMCRs to their legislated values but rather to target values lower than the legislated rates. Such mechanism creates a kind of provision for adverse deviation that is aimed at stabilizing the level of benefits and contribution rates.

## 5. Example of Adjustment to Benefits Resulting from the Application of the Additional CPP Sustainability Regulations

This subsection provides examples that show how the provisions of the additional CPP Sustainability Regulations would be applied in the case of both an initial adjustment to benefits and a later reversal of that adjustment for current and future beneficiaries.

For a general case, Chart 10 shows examples of how benefits could be with a later reversal of the adjustments. The increase of the original benefit in line with regular inflation indexation is also shown. In the first case, the growth of Benefit 1 is first reduced over a six-year period 2049-2054 assuming a reduced indexation of 60% of the change in the CPI is applied. Thereafter, regular indexation resumes up until the year 2064. Over the period 2064-2069, benefit indexation is then increased to reverse the prior decreases. By 2070, Benefit 1 reverts to its initial projected level. Similarly, Benefit 2 is first increased with a later reversal.

**Chart 10 Example of Evolution of Original Benefits and Adjusted Benefits with Later Reversal of Adjustments**



The following examples provide more details for different subgroups of additional Plan participants. For these examples, it is assumed that initial adjustments to benefits are made according to the provisions of subsection 11(1) of the additional CPP Sustainability Regulations (deficit without previous increases in benefits) and that the provisions of subsection 7(1) (reversal of previous reductions in benefits) are applied later on.

It is assumed that after the review period 2046-2048 the application of the financial sustainability provisions (as described in subsection 3.a of this study) requires the application of reduced indexation of 60% of the change in the CPI to benefits in pay over the six years following the end of the review period (i.e., from 2049 to 2054 inclusive) and the application of benefit multipliers for new benefits. Assuming inflation of 2% per year, the reduction in indexation will reduce benefit amounts in pay as at 1 January 2049 by 5% after six years:

*Impact of annual indexation of 1.2% instead of 2% for six years:  $(1.012/1.020)^6 - 1 = - 5\%$ .*

As such, at the end of the six-year adjusted indexation period in 2054, benefits in pay will be equal to 95% of what their value would have been with no adjustment. After 2054, regular indexation (at 2%) resumes, so that adjusted benefits remain equal to 95% of their unadjusted amounts.

Let us consider a beneficiary, John, who is paid a monthly retirement pension of \$1,000 starting January 1, 2048. Table 6 illustrates how John would be affected.

**Table 6 Application of Adjusted Indexation to Benefits in Pay (section 10) – John**

Year	Original benefit (January 1)		Adjusted benefit (January 1)		Ratio of Adjusted to Original Benefit
	Indexation	Amount (\$)	Indexation	Amount*(\$)	
2048	1.02	1,000	1.020	1,000	1.000
2049	1.02	1,020	1.012	1,012	0.992
2050	1.02	1,040	1.012	1,024	0.984
2051	1.02	1,061	1.012	1,036	0.977
2052	1.02	1,082	1.012	1,049	0.969
2053	1.02	1,104	1.012	1,061	0.961
2054	1.02	1,126	1.012	1,074	0.954
2055	1.02	1,149	1.020	1,096	0.954

\*Amounts may not be equal to the product of the indexation and previous year amount due to the accumulated rounding error.

In order to satisfy Condition 3 of subsection 3.a of this study, the following multipliers would need to be applied to new benefits: 0.992 for year 2049, 0.984 for 2050, 0.977 for 2051, 0.969 for 2052, 0.961 for 2053, and 0.954 for all new benefits in years 2054 and thereafter, i.e. a reduction of 5% in the original benefits. As can be seen from Table 6, these multipliers simply equal the ratios of the cumulative adjustment to indexation of benefits in pay. The way benefit multipliers are calculated is prescribed by section 9 of the Regulations.

Note that there are three groups of beneficiaries who are affected by the benefit adjustments. First, there are the beneficiaries in pay as at the start of the adjusted indexation period (2049), like John. Second, there are new beneficiaries who start their benefit within the adjusted indexation period, but prior to its last year (2049-2053). These new beneficiaries would see a cumulative reduction in their

benefits from a combination of the application of the benefit multiplier in the first year of payment (reflecting previous forgone indexation for those beneficiaries in pay) and a reduction due to future forgone indexation. Lastly, the third group consists of new beneficiaries who start their pension on or after the last year of the adjusted indexation period (2054+). For these new beneficiaries, the reduction in their benefits will result entirely from the application of the benefit multiplier (0.95), which is equal to the ratio of the total cumulative adjusted indexation over the six years for benefits in pay. The last two groups of beneficiaries may be required to pay higher contributions as well.

Let us next consider a new beneficiary, Anne, who starts her retirement benefit on January 1, 2050 (within the adjusted indexation period) with an original initial monthly benefit amount of \$1,000. Table 7 illustrates the combined application of a benefit multiplier and reduced indexation for Anne. Since she starts her benefit in 2050, her benefit multiplier is 0.984, and her original benefit of \$1,000 will be adjusted to \$984. Her benefit will then be indexed going forward according to the adjusted indexation of 1.2% until 2054, with reversion to regular indexation from 2055 onward. As such, her overall adjusted benefit will be worth 98% of its unadjusted value in 2051, 97% of its unadjusted value in 2052, 96% in 2053, and finally 95% from 2054 onward.

To further explain the adjustment to Anne's benefit, consider the combined adjustment of 95% in 2053. This adjustment is determined as the product of her benefit multiplier of 0.984 and the cumulative impact of 0.97 from the reduced indexation in years 2051, 2052, 2053 and 2054, that is:  $0.954 = 0.984 \times (1.012/1.02)^4 = 0.984 \times 0.97$ .

**Table 7 Application of Adjusted Indexation to Benefits in Pay (section 10) – Anne**

Year	Original benefit (January 1)		Adjusted benefit (January 1)			Ratio of Adjusted to Original Benefit
	Indexation	Amount (\$)	Benefit Adjustment Factor	Indexation	Amount*(\$)	
2050	n/a	1,000	0.984	n/a	984	0.984
2051	1.02	1,020	n/a	1.012	996	0.977
2052	1.02	1,040	n/a	1.012	1,008	0.969
2053	1.02	1,061	n/a	1.012	1,020	0.961
2054	1.02	1,082	n/a	1.012	1,032	0.954
2055	1.02	1,104	n/a	1.020	1,053	0.954

\*Amounts may not be equal to the product of the indexation and previous year amount due to the accumulated rounding error.

Finally, consider a new beneficiary, Pierre, who starts his retirement benefit on January 1, 2054 with an original benefit amount of \$1,000. His benefit multiplier is 0.954 and his adjusted benefit would be \$954, i.e. the product of the original benefit of \$1,000 and the benefit multiplier of 0.954. Pierre's benefit will be indexed from 2055 onward with the full CPI, and the ratio of his benefit to the unadjusted benefit will remain at 0.954. All new beneficiaries after January 1, 2054 would likewise have a benefit multiplier of 0.954 applied to their benefits with full CPI indexation applied thereafter.

What would happen if the financial situation of the additional Plan later improved and the adjustments discussed above needed to be reversed?

Let us assume that as per subsection 7(1) of the Regulations the reversal starts after the 2061-2063 review period in 2064, and the previous adjustments are phased out over six years from 2064 to 2069,



i.e., additional indexation is provided to beneficiaries such that the ratio of adjusted to original legislated benefits increases gradually from 0.954 to 1.00. Note that by simply providing additional indexation, the unadjusted benefit amounts are restored for all three groups of beneficiaries. This is because the benefit multipliers applied to new benefits were equal to the cumulative adjustment in indexation up to the date of the start of benefits. So, what will happen to John's, Anne's, and Pierre's benefits?

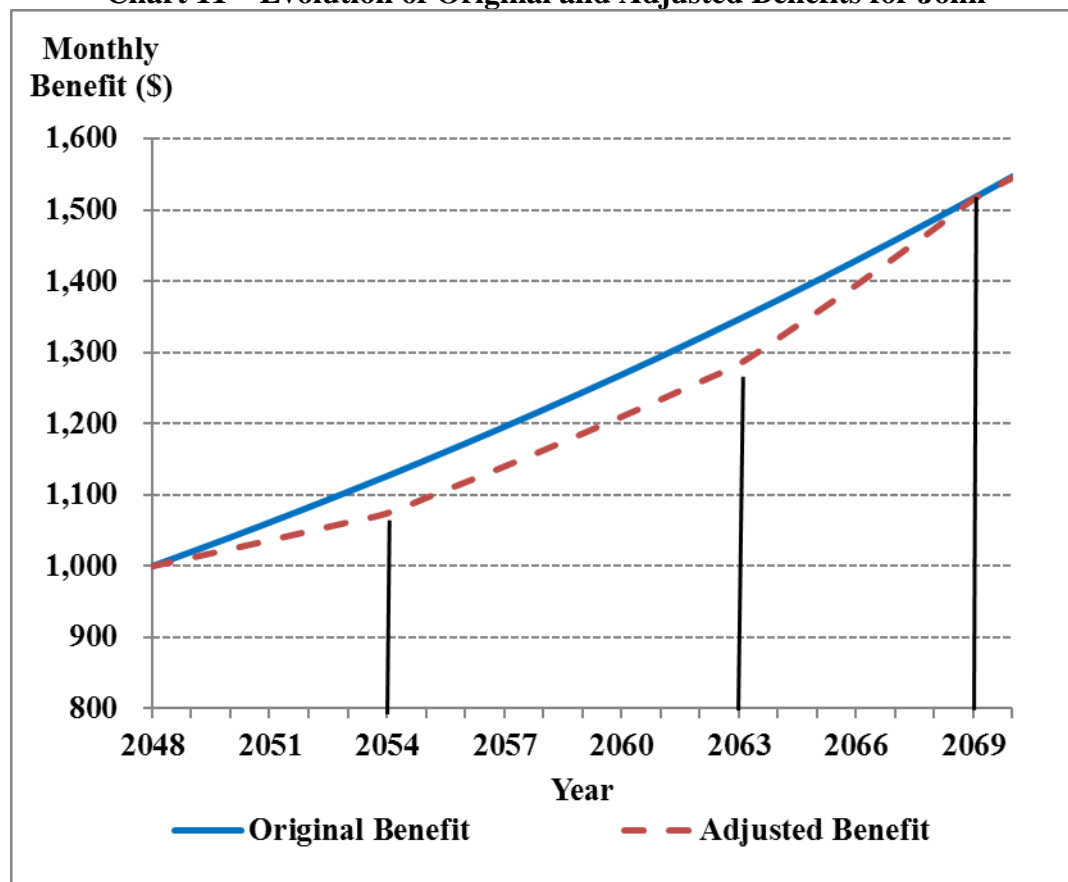
Table 8, which is an extension of Table 6, shows the evolution of John's benefit. From 2055 to 2063, John's benefit will be indexed in accordance with increases in the CPI (assumed to be 2%). When the reversal of the past adjustment starts in 2064, John's benefit will increase by 2.8% each year up to and including 2069. This annual increase of 2.8% is composed of the 2% increase due to the regular indexation and a 0.8% increase due to the gradual reversal of the previous reductions. As a result, by 2069, John's benefit will revert to the original value. Chart 11 shows graphically the evolution of the original and adjusted benefits for John.

**Table 8 Evolution of John's Benefit Due to Application of Subsections 11(1) and 7(1)**

Year	Original benefit (January 1)		Adjusted benefit (January 1)		Ratio of Adjusted to Original Benefit
	Indexation	Amount (\$)	Indexation	Amount* (\$)	
2048	1.02	1,000	1.020	1,000	1.009
2049	1.02	1,020	1.012	1,012	0.992
2050	1.02	1,040	1.012	1,024	0.984
2051	1.02	1,061	1.012	1,036	0.977
2052	1.02	1,082	1.012	1,049	0.969
2053	1.02	1,104	1.012	1,061	0.961
2054	1.02	1,126	1.012	1,074	0.954
2055	1.02	1,149	1.020	1,096	0.954
...	...	...	...	...	...
2063	1.02	1,346	1.020	1,284	0.954
2064	1.02	1,373	1.028	1,320	0.961
2065	1.02	1,400	1.028	1,357	0.969
2066	1.02	1,428	1.028	1,395	0.977
2067	1.02	1,457	1.028	1,434	0.984
2068	1.02	1,486	1.028	1,474	0.992
2069	1.02	1,516	1.028	1,515	1.000
2070	1.02	1,546	1.020	1,546	1.000

\*Amounts may not be equal to the product of the indexation and previous year amount due to the accumulated rounding error.

**Chart 11 Evolution of Original and Adjusted Benefits for John**



Anne's benefit will be readjusted similarly as shown in Table 9 (extension of Table 7). By 2069, her benefit will be restored to the original amount that was expected to be paid prior to the application of the financial sustainability provisions. As such, the actions of subsection 7(1) will result in reversing the reductions in the benefit that came from the application of the benefit multiplier and adjusted indexation.

**Table 9 Evolution of Anne's Benefit Due to Application of Subsections 11(1) and 7(1)**

Year	Original benefit (January 1)		Adjusted benefit (January 1)			Ratio of Adjusted to Original Benefit
	Indexation	Amount (\$)	Benefit Multiplier	Indexation	Amount* (\$)	
2050	n/a	1,000	0.984	n/a	984	0.984
2051	1.02	1,020	n/a	1.012	996	0.977
2052	1.02	1,040	n/a	1.012	1,008	0.969
2053	1.02	1,061	n/a	1.012	1,020	0.961
2054	1.02	1,082	n/a	1.012	1,032	0.954
2055	1.02	1,104	n/a	1.020	1,053	0.954
...	...	...	...	...	...	...
2063	1.02	1,294	n/a	1.020	1,234	0.954
2064	1.02	1,319	n/a	1.028	1,268	0.961
2065	1.02	1,346	n/a	1.028	1,304	0.969
2066	1.02	1,373	n/a	1.028	1,340	0.977
2067	1.02	1,400	n/a	1.028	1,378	0.984
2068	1.02	1,428	n/a	1.028	1,417	0.992
2069	1.02	1,457	n/a	1.028	1,457	1.000
2070	1.02	1,486	n/a	1.020	1,486	1.000

\*Amounts may not be equal to the product of the indexation and previous year amount due to the accumulated rounding error.

For Pierre, the application of actions of subsection 7(1) of the Regulations will restore his original benefit by removing the impact of the application of the benefit multiplier. Table 10 shows the evolution of his benefits.

**Table 10 Evolution of Pierre's Benefit Due to Application of Subsections 11(1) and 7(1)**

Year	Original benefit (January 1)		Adjusted benefit (January 1)			Ratio of Adjusted to Original Benefit
	Indexation	Amount (\$)	Benefit Multiplier	Indexation	Amount* (\$)	
2054	n/a	1,000	0.954	n/a	954	0.954
2055	1.02	1,020	n/a	1.020	973	0.954
...	...	...	...	...	...	...
2063	1.02	1,195	n/a	1.020	1,140	0.954
2064	1.02	1,219	n/a	1.028	1,172	0.961
2065	1.02	1,243	n/a	1.028	1,205	0.969
2066	1.02	1,268	n/a	1.028	1,238	0.977
2067	1.02	1,294	n/a	1.028	1,273	0.984
2068	1.02	1,319	n/a	1.028	1,309	0.992
2069	1.02	1,346	n/a	1.028	1,345	1.000
2070	1.02	1,373	n/a	1.020	1,373	1.000

\*Amounts may not be equal to the product of the indexation and previous year amount due to the accumulated rounding error.

Lastly, there is one more group of beneficiaries to be considered, namely those who start their benefits during the adjustment reversal period. For example, say Maya starts her retirement benefit in 2066, with an original amount of \$1,000 per month. Her benefit would initially be adjusted by 0.977 and

then gradually increased to 1.00, as shown in Table 11. Maya's benefit is initially only adjusted by a benefit multiplier of 0.977 and not 0.954, since she starts her benefit within the adjustment reversal period and not before it. The size of the reduction decreases throughout the reversal period as the ratio of adjusted to original benefits increases to 1.00. From the end of the reversal period onward, there would be no benefit adjustments for all beneficiaries.

**Table 11 Evolution of Maya's Benefit Due to Application of Subsections 11(1) and 7(1)**

Year	Original benefit (January 1)		Adjusted benefit (January 1)			Ratio of Adjusted to Original Benefit
	Indexation	Amount (\$)	Benefit Multiplier	Indexation	Amount* (\$)	
2066	n/a	1,000	0.977	n/a	977	0.977
2067	1.02	1,020	n/a	1.028	1,004	0.984
2068	1.02	1,040	n/a	1.028	1,033	0.992
2069	1.02	1,061	n/a	1.028	1,061	1.000
2070	1.02	1,082	n/a	1.020	1,082	1.000

\*Amounts may not be equal to the product of the indexation and previous year amount due to the accumulated rounding error

## 6. Illustrations of the Impacts of the Additional CPP Sustainability Regulations on the FAMCR and SAMCR

This section provides illustrations of the impacts of the proposed sustainability provisions on the FAMCR over time. All examples are based on projections using the best-estimate assumptions of CPP29 and the legislated additional contribution rates. Further, all examples assume that there were no previous adjustments to benefits or contribution rates prior to the considered valuation dates. For any projection of the additional CPP, the AMCRs are determined according the *Calculations of Contribution Rates Regulations, 2018*. Since the SAMCR is always four times the value of the FAMCR, for simplicity, all illustrations pertain only to the FAMCR, where it is understood that the fourfold impacts would apply to the SAMCR. It should be noted that these examples are only illustrations, and real life situations will likely differ from those presented. All illustrations are based on an assumed annual inflation rate of 2.0%.

Table 12 shows the impacts on benefit amounts (as percentages) that result from various reductions/increases in indexation over six years. The benefit multipliers equal the cumulative value of the adjusted indexation over the six years. For instance, as shown by the Examples in the previous subsection, if the indexation of benefits in pay is 60% of the change in the CPI (1.2% instead of an assumed 2%) during a six-year period, then the resulting benefits in pay at the end of six years will be 95% of what would have been payable if full indexation had been provided ( $0.95 = (1.012/1.02)^6$ ), and the benefit multiplier for new benefits starting in 2054 and later will be 0.95. For new benefits starting between 2049 and 2053, the multipliers reflect the cumulative reduction in benefit indexation up to the starting year.

**Table 12 Impact on Benefit Amounts in Pay of Various Indexation Adjustments (2.0% inflation)**

<b>Indexation (percentage of change in the CPI)</b>	<b>75%</b>	<b>67%</b>	<b>60%</b>	<b>33%*</b>	<b>25%*</b>	<b>0% *</b>
<b>Relative adjusted benefit with respect to original benefit after 6 years</b>	97%	96%	95%	92%*	91%*	89%*
<b>Indexation (percentage change in the CPI)</b>	<b>125%</b>	<b>133%</b>	<b>140%</b>	<b>167%</b>	<b>175%</b>	<b>200%</b>
<b>Relative adjusted benefit with respect to original benefit after 6 years</b>	103%	104%	105%	108%	109%	112%

\* The impacts on benefits of the indexation at 33%, 25% and 0% of the change of the CPI are shown for illustration purpose only - these levels of indexation are not permitted under the proposed additional CPP Sustainability Regulations.

### Short Term

As was discussed in section III.B of this paper, it is estimated that the likelihood the financial sustainability provisions would apply during the first two decades following the inception of the additional Plan is quite low. At the same time, if such need were to arise because the AMCRs were higher than the legislated contribution rates, the impact on the AMCRs from adjustments to benefits as per subsection 11(1) of the Regulations would be quite limited. The adjustments would come mainly from the benefit multipliers since there are more contributors (i.e. future beneficiaries) than beneficiaries in pay and the value of benefits in pay is small in the early years. For example, in 2024, it is estimated that providing indexation at 60% of the change in the CPI to benefits in pay (an increase of 1.2% per year instead of 2%) for the six years 2028-2033 would not have any material impact on the FAMCR. On the other hand, the impact on the FAMCR of the corresponding benefit multiplier of 0.95 phased in by 2033 would be 10 bps. Given the magnitude of the impact of the reduction in benefits, in the unlikely situation that adjustments from the actions of section 11 of the additional CPP Sustainability Regulations would be required, both subsections 11(1) and 11(2) would apply, i.e. both benefits and contribution rates would need to be adjusted.

In general, as the additional Plan matures the impact of the loss of indexation of benefits in pay increases. However, as noted before, even at maturity, the impact of benefit multipliers on the AMCRs will always be higher than the impact of the corresponding reduction in indexation. This is a direct result of the relative number of plan participants affected by each measure: a reduction in indexation only affects the current beneficiaries, while the benefit multipliers affect current and future contributors – a much larger group.

### Medium term

The following examples illustrate the impacts of the application of the additional CPP Sustainability Regulations in respect of the FAMCR determined as at 31 December 2045 (actuarial valuation date) with the corresponding review period 2046-2048. As such, all adjustments in benefits, if any, would apply starting in 2049.

In 2045, the additional Plan is still maturing and, according to CPP29, benefits in pay are projected to be \$17 billion in 2045 dollars or \$9.6 billion in 2016 dollars (compared to, for example, \$51 billion in

2016 dollars in 2075). As a result, and as shown in Tables 13 and 14, the impacts on the FAMCR of changes in the indexation of benefits in pay over six years are quite modest. We also observe that these impacts are quite symmetrical with respect to a decrease/increase in benefit indexation.

According to Condition 3 of subsections III.D.2.a and III.D.3.a of this study, the cumulative decrease/increase in benefits in pay provides a value for the multipliers of future new benefits, as described above.

Tables 13 and 14 show the impact on the FAMCR from adjusting benefits at different rates of indexation.

**Table 13 Decrease in FAMCR Due to Reduction in Indexation of Benefits in Pay over Six Years (2049-2054) and Application of Benefit Multipliers**

Indexation (percentage of change in the CPI)	75%	67%	60%
<b>Benefit multiplier (2054+)</b>	0.97	0.96	0.95
<b>Decrease in the FAMCR</b>			
- From reduction in indexation	1 bps	1 bps	2 bps
- From benefit multipliers	7 bps	10 bps	12 bps
- Total Decrease	8 bps	11 bps	14 bps

**Table 14 Increase in FAMCR Due to Increase in Indexation of Benefits in Pay over Six Years (2049-2054) and Application of Benefit Multipliers**

Indexation (percentage of change in the CPI)	125%	140%	150%	167%	175%	200%
<b>Benefit multiplier (2054+)</b>	1.03	1.05	1.06	1.08	1.09	1.12
<b>Increase in the FAMCR</b>						
- From increase in indexation	1 bps	1 bps	2 bps	2 bps	3 bps	4 bps
- From benefit multipliers	8 bps	13 bps	16 bps	21 bps	23 bps	31 bps
- Total Increase	9 bps	14 bps	18 bps	23 bps	26 bps	35 bps

Condition 1 of subsection III.D.3.a of this study imposes further restrictions on the extent of the reduction in the indexation for benefits in pay and the size of benefit multipliers. Since the indexation of benefits in pay cannot be lower than 60% of the change in the CPI, under the assumption of annual inflation of 2%, the growth of benefits cannot be reduced by more than 5%. Further, the maximum overall impact of the reduction in indexation and benefit multipliers is estimated to be a 14 bps reduction in the FAMCR (56 bps in the SAMCR), as shown in Table 13.

Assuming an adjustment period of six years, the overall impact of the increase in indexation and benefit multipliers cannot produce more than a 35 bps increase in the FAMCR (140 bps in SAMCR), based on Table 14. Such impacts could be achieved by providing an indexation of 200% of the change in the CPI to benefits in pay over the six years from 2049 to 2054, and applying a benefit multiplier of 1.12. In particular, it means that the benefits cannot be increased by more than 12%.

Based on Tables 13 and 14, it is possible to determine how benefits and contributions rates are to be adjusted depending on the values of the AMCRs. As shown in Table 15, if, for example, the FAMCR is determined to be 2.3% as at 31 December 2045, and the stewards of the Plan do not agree on any course of action, then the actions of the additional CPP Sustainability Regulations would be activated. As such, since it is assumed that no previous adjustments to the additional Plan took place, the provisions of subsection 11(1) of Regulations would apply. In this case, benefits in pay would be indexed at 60% of the change in the CPI for six years from 2049 to 2054, and a benefit multiplier of 0.95 would apply to future new benefits from 2054 onward, with prorating for years 2049 to 2053. These actions would reduce the FAMCR of 2.3% by 14 bps to 2.16%. Since the AMCRs would still be higher than the legislated rates, subsection 11(1) of Regulations would apply and deem the first and second additional contribution rates to increase to 2.16% and 8.64%, respectively.

In the case where the AMCRs are below the legislated rates, the increases in benefits should satisfy Condition 1 of section III.D.2.a of this study and bring the FAMCR to 1.9% instead of the legislated rate of 2.0%.

**Table 15 Application of Financial Sustainability Provision (2049-2054) Based on FAMCR as at 31 December 2045**

<b>FAMCR as at 31.12.2045 (A)</b>	<b>1.64%</b>	<b>1.72%<sup>(1)</sup></b>	<b>2.11%<sup>(1)</sup></b>	<b>2.2%</b>	<b>2.3%</b>
<b>Legislated first additional contribution rate (B)</b>	2.0%	2.0%	2.0%	2.0%	2.0%
<b>Modified indexation (2049-2054) (percentage of change in the CPI)</b>	175%	150%	67%	60%	60%
<b>Benefit multiplier (2054+)</b>	1.09	1.06	0.96	0.95	0.95
<b>Increase (decrease) in the FAMCR (subsection 7(1) or 11(1) of the Regulations)</b>					
- <b>From adjustment in indexation</b>	3 bps	2 bps	(1) bps	(2) bps	(2) bps
- <b>From benefit multipliers</b>	23 bps	16 bps	(10) bps	(12) bps	(12) bps
- <b>Total Increase (decrease) (C)</b>	26 bps	18 bps	(11) bps	(14) bps	(14) bps
<b>New FAMCR after application of subsection 7(1) or 11(1) of the Regulations (D) = (A)+(C)</b>	1.90%	1.90%	2.0%	2.06%	2.16%
<b>Deemed increase (decrease) in the legislated first additional contribution rate from 2049 (subsection 11(2)) (D) – (B)</b>	N/A	N/A	0 bps	6 bps	16 bps
<b>Deemed first additional contribution rate starting from 2049</b>	2.0%	2.0%	2.0%	2.06%	2.16%

(1) It is assumed that the FAMCR was in a Warning Range for two actuarial reports in a row.

It should be reiterated that there is a possibility that at some point in the future these changes in benefits and contribution rates might be partially or fully reversed.

### Long term

The next examples illustrate the application of the financial sustainability provisions in respect of the AMCRs determined as at the 31 December 2075 valuation, with the corresponding review period 2076-2078. As such, all adjustments in benefits, if any, would apply starting in 2079.

In 2075, the additional Plan is maturing and, according to CPP29, benefits in pay in 2075 are projected to be \$165 billion in 2075 dollars or \$51 billion in 2016 dollars. As a result, as shown in Tables 16 and 17, the impacts of changes in indexation of benefits in pay over six years on the AMCRs will become more significant. Once again, these impacts are quite symmetrical with respect to decreases/increases in benefit indexation.

As in the previous example, according to Condition 3 of subsections III.D.2.a and III.D.3.a of this study, the cumulative decrease/increase in benefits in pay provides a value for the multipliers of future new benefits. Tables 16 and 17 summarize the potential impacts on the FAMCR if these conditions are satisfied.



**Table 16 Decrease in FAMCR Due to Reduction in Indexation of Benefits in Pay over Six Years (2079-2084) and Application of Benefit Multipliers**

Indexation (percentage of change in the CPI)	75%	67%	60%
<b>Benefit multiplier (2084+)</b>	0.97	0.96	0.95
<b>Decrease in the FAMCR</b>			
- From reduction in indexation	2 bps	3 bps	3 bps
- From benefit multipliers	8 bps	11 bps	14 bps
- <b>Total Decrease</b>	10 bps	14 bps	17 bps

**Table 17 Increase in FAMCR Due to Increase in Indexation of Benefits in Pay over Six Years (2079-2084) and Application of Benefit Multipliers**

Indexation (percentage of change in the CPI)	125%	140%	150%	167%	175%	200%
<b>Benefit multiplier (2084+)</b>	1.03	1.05	1.06	1.08	1.09	1.12
<b>Increase in the FAMCR</b>						
- From increase in indexation	2 bps	3 bps	4 bps	5 bps	6 bps	8 bps
- From benefit multipliers	8 bps	13 bps	16 bps	21 bps	24 bps	32 bps
- <b>Total Increase</b>	10 bps	16 bps	20 bps	26 bps	30 bps	40 bps

Condition 1 of subsection III.D.3.a of the study imposes further restrictions on the extent of the reduction in the indexation for benefits in pay and the size of benefit multipliers. Since the indexation of benefits in pay cannot be lower than 60% of the change in the CPI, the growth of benefits cannot be reduced by more than 5%, as shown earlier, assuming inflation of 2%. The maximum overall impact of the reduction in indexation and benefit multipliers is estimated to be a 17 bps reduction in the FAMCR (68 bps in the SAMCR), as shown in Table 16.

Based on Tables 16 and 17, it is possible to determine how benefits and contributions rates should be adjusted depending on the values of the AMCRs. As shown in Table 18, if, for example, the FAMCR is determined to be 2.3% as at 31 December 2075, and the stewards of the Plan do not agree on any course of action, then the actions of the additional CPP Sustainability Regulations would apply. Since it is assumed that no previous adjustments to the additional Plan took place, the provisions of subsection 11(1) of the Regulations would apply. As such, benefits in pay would be indexed at 60% of the change in the CPI for six years from 2079 to 2084, and a benefit multiplier of 0.95 would apply to future new benefits from 2084 onward, with prorating for years 2079 to 2083. These actions will reduce the FAMCR of 2.3% by 17 bps to 2.13%. Since the AMCRs would still be higher than the legislated rates, subsection 11(2) would apply and the first and second additional contribution rates would be deemed to increase to 2.13% and 8.52%, respectively.

In the case where the AMCRs are below the legislated rates, the increases in benefits should satisfy Condition 1 of subsection III.D.2.a of this study and bring the FAMCR to 1.9% instead of the legislated rate of 2.0%.

**Table 18 Application of Financial Sustainability Provision (2079-2084) by FAMCR as at 31 December 2075**

<b>FAMCR as at 31.12.2075 (A)</b>	<b>1.64%</b>	<b>1.74%<sup>(1)</sup></b>	<b>2.14%<sup>(1)</sup></b>	<b>2.2%</b>	<b>2.3%</b>
<b>Legislated first additional contribution rate (B)</b>	2.0%	2.0%	2.0%	2.0%	2.0%
<b>Modified indexation (2079-2084) (percentage of change in the CPI)</b>	167%	140%	67%	60%	60%
<b>Benefit multiplier (2084+)</b>	1.08	1.05	0.96	0.95	0.95
<b>Increase (decrease) in the FAMCR (subsection 7(1) or 11(1) of the Regulations)</b>					
- <b>From adjustment in indexation</b>	5 bps	3 bps	(3) bps	(3) bps	(3) bps
- <b>From benefit multipliers</b>	21 bps	13 bps	(11) bps	(14) bps	(14) bps
- <b>Total Increase (decrease) (C)</b>	26 bps	16 bps	(14) bps	(17) bps	(17) bps
<b>New FAMCR after application of subsection 7(1) or 11(1) of the Regulations (D) = (A)+(C)</b>	1.90%	1.90%	2.00%	2.03%	2.13%
<b>Increase (decrease) in the legislated first additional contribution rate from 2079 (subsection 11(2)) (D) – (B)</b>	N/A	N/A	0 bps	3 bps	13 bps
<b>Deemed first additional contribution rate starting from 2079</b>	2.0%	2.0%	2.0%	2.03%	2.13%

(1) It is assumed that the FAMCR was in a Warning Range for two actuarial reports in a row.

It should be reiterated that there is a possibility that at some point in the future that these changes in benefits and contribution rates might be partially or fully reversed.

Appendix F provides more examples on the application of the additional CPP Sustainability Regulations.

## **7. Impact of the Financial Sustainability Provisions on the Internal Rate of Return of Participants**

There are multiple measures of intergenerational equity for a social security program. One of these measures is the internal rate of return (IRR). The internal rate of return with respect to an individual is the unique interest rate resulting from the equality of:

- the present value of past and future contributions (both employee and employer portions) paid or expected to be paid by and in respect of an individual, and
- the present value of past and future benefits earned or expected to be earned by that individual.

Accordingly, actual internal rates of return cannot be determined until an individual has died. However, they can be estimated based on assumptions as to future experience.

Chart 12 illustrates the impact of changes in benefits and contributions on the nominal IRRs for individuals aged 25, 35, 45, 55, 65, 75 and 85 years old at the time the provisions of the additional CPP Sustainability Regulations are activated.

It should be noted that this is a simplified illustration that assumes that each individual starts contributing to the additional CPP at age 25 and asks for his/her retirement benefit at age 65 after 40 years of contributions. It is further assumed that an individual earns 100% of the YMPE during his/her whole career. In all examples, the retirement benefit is received for 26 years.

The first illustration assumes that, as at 31 December 2075, the FAMCR is determined to be 2.3%, which triggers the application of the financial sustainability provisions in the case Ministers of Finance do not reach an agreement on actions to take.

For illustration purposes, two theoretical alternatives to reduce the FAMCR from 2.3% to 2.0% are considered. Under the first one, “Benefits only”, only adjustments to current and future benefits are applied (the indexation of benefits in pay is provided at 25% of the change in the CPI over the 6 years 2079 to 2084, and a benefit adjustment factor of 0.91 is applied to new benefits). Under the second scenario, “Contributions only”, the legislated additional contribution rates are deemed to be increased in 2079 to reach 2.3% and 9.2%.

The nominal IRR is calculated for each individual at age 25 under the original plan (before any adjustment), as well as under the two alternatives. Under the original plan, the nominal IRR at age 25 under the given assumptions is 5.76% for all selected individuals (orange bars in Chart 12) independent of the age at the time of adjustment.

Both a reduction in benefits and increase in contribution rates would consequently decrease the IRRs. However, under the “Benefits only” scenario (red bars in Chart 12) the IRR for contributors is lower at 5.47% and does not depend on the age of a contributor. In particular, it means that all current contributors, as well as future generations of contributors not included in this illustration, are being treated similarly. For beneficiaries, the nominal IRR increases with age since older beneficiaries will receive reduced benefits for a shorter period of time than younger ones. Overall, the burden of the adjustment is spread equitably among contributors, and the impact on beneficiaries diminishes with age.

Under the “Contributions only” scenario (navy bars in Chart 12), only contributors are affected with beneficiaries continuing to receive the same benefit and, thus, have the same IRRs. Furthermore, the younger a contributor is, the greater is the reduction in his/her IRR. Such an approach shifts the burden of adjustment to current younger generations as well as to future generations.

**Chart 12 Nominal Internal Rates of Return at Age 25: Comparison of Contributions Only vs Benefits Only Adjustment Approaches (FAMCR of 2.3% determined as at 31 December 2075)**

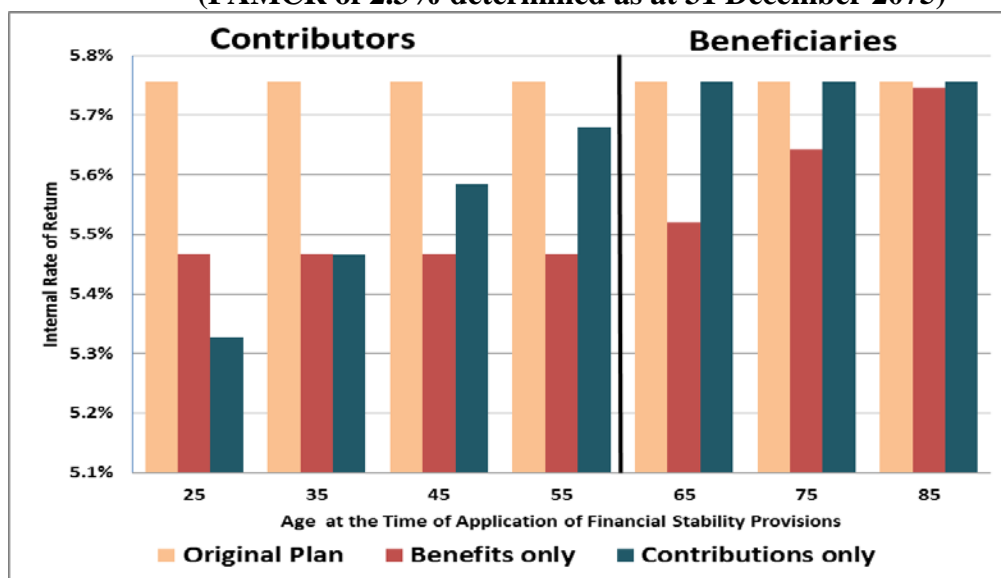
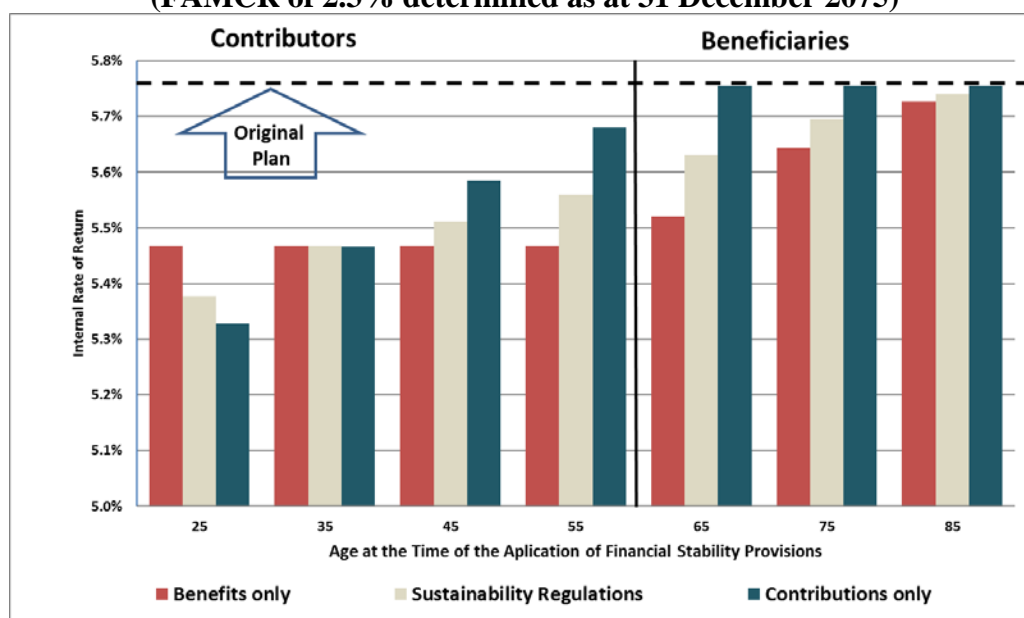


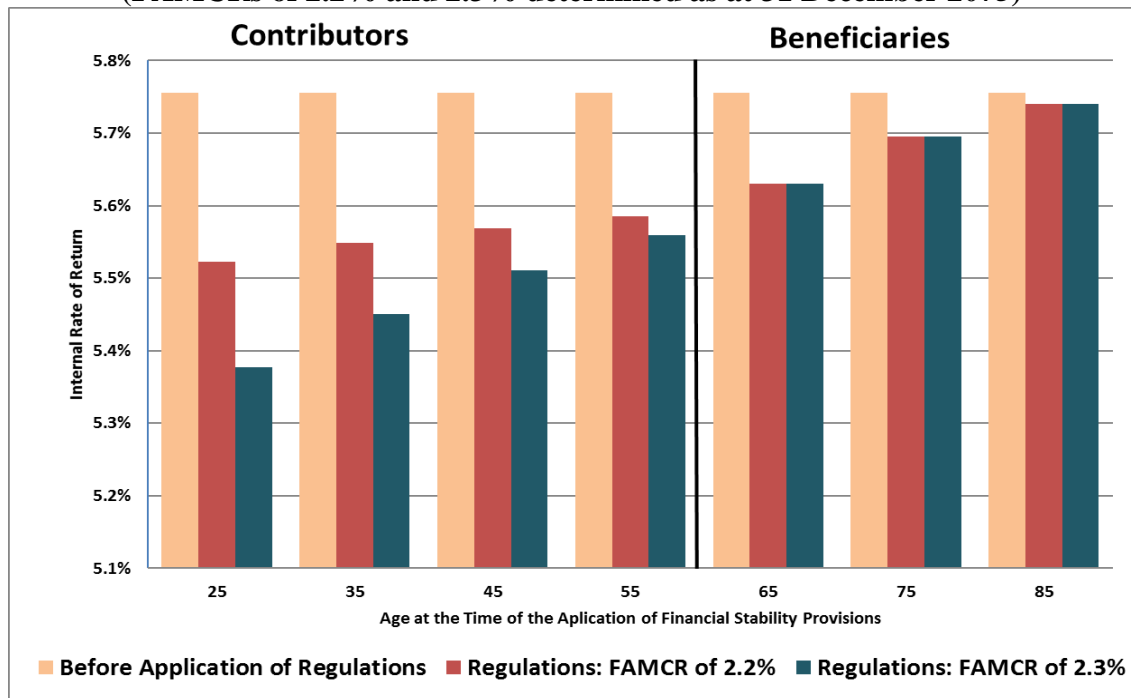
Chart 13 illustrates that the approach defined in the additional CPP Sustainability Regulations (grey bars) is situated between a “Benefits only” (red bars) and “Contributions only” (blue bars) approach. It can be seen that the approach defined in the Regulations results in lower differences in the nominal IRR by age. Further, this approach is more favourable to younger participants (under age 35) than the “Contributions only” approach.

**Chart 13 Nominal Internal Rates of Return at Age 25: Comparison of Additional CPP Sustainability Regulations Approach with Contributions Only and Benefits Only Approaches (FAMCR of 2.3% determined as at 31 December 2075)**



The impacts of the approach defined in the additional CPP Sustainability Regulations on the IRR are further illustrated in Chart 14 under the assumptions that the FAMCR determined as at 31 December 2075 is 2.2% or 2.3%. Under the scenario of an FAMCR of 2.2% (red bars), the IRRs for younger ages vary much less than under the second scenario of FAMCR of 2.3% (blue bars), since the change in the contribution rates is quite small. In both cases, impacts on contributors differ by age but are lower than under the “Contributions only” scenario. For beneficiaries, the impacts are same under the both scenarios since the additional CPP Sustainability Regulations limits the adjustments to benefits in pay.

**Chart 14 Financial Sustainability Provisions: Nominal Internal Rates of Return at Age 25 (FAMCRs of 2.2% and 2.3% determined as at 31 December 2075)**



## IV. Conclusion

This study supplements the pre-publication of proposed regulations in respect of the Canada Pension Plan: *Calculation of Contribution Rates Regulations, 2018* and the *Additional Canada Pension Plan Sustainability Regulations*. The study provides technical information on the methodology presented in these regulations and discusses their applications.

The methodology for calculating the contribution rates for the additional Plan as defined in the Contribution Rates Regulations is consistent with the statutory requirements that such rates should be sufficient and stable. It is aligned with the fact that the additional CPP covers multiple generations of Canadians. Finally, this methodology remains appropriate in economic and demographic environments that differ from best estimates of the Chief Actuary.

The additional CPP Sustainability Regulations are aimed at preserving the financial sustainability of the additional Plan (i.e. preventing both substantial underfunding and overfunding), ensuring the stability of the additional contribution rates, and reducing the risk of future reductions in benefits and/or increases in the contribution rates.

The additional CPP Sustainability Regulations are a default mechanism that would apply only if the additional contribution rates necessary to sustain the additional Plan differ significantly from the legislated rates and the federal and provincial Finance Ministers do not reach agreement on a course of actions. In other words, even if the required contribution rates trigger the activation of the provisions of the additional CPP Sustainability Regulations, this could be overridden by the Finance Ministers.

The design of the additional CPP Sustainability Regulations shares adjustments between current beneficiaries, contributors and their employers. It aims at minimizing intergenerational transfers to be consistent with the design and financing objectives of the additional Plan, and provides to all generations of Canadians the confidence of being treated fairly.

## Appendix A – Best-Estimate Assumptions of the 27th, 28th and 29th CPP Actuarial Reports

**Table 19 Best-Estimate Demographic and Economic Assumptions**

27 <sup>th</sup> , 28 <sup>th</sup> and 29 <sup>th</sup> CPP Actuarial Reports (as at 31 December 2015)		
Canada		
Total fertility rate	1.65 (2019+)	
Mortality	Canadian Human Mortality Database (CHMD 2011) with assumed future improvements	
Canadian life expectancy	Males	Females
at birth in 2016	86.7 years	89.7 years
at age 65 in 2016	21.3 years	23.7 years
Net migration rate	0.62% of population (2016+)	
Participation rate (age group 15-69)	77.5%	(2035)
Employment rate (age group 15-69)	72.6%	(2035)
Unemployment rate	6.2%	(2025+)
Rate of increase in prices	2.0%	(2017+)
Real wage increase	1.1%	(2025+)
Real rate of return (average 2019-2093)	Base CPP Assets	3.98%
	Additional CPP Assets	3.55%
Retirement rates for cohort at age 60	Males	34% (2016+)
	Females	38% (2016+)
CPP disability incidence rates (per 1,000 eligible)	Males	3.10 (2020+)
	Females	3.65 (2020+)

## **Appendix B – Selected *Canada Pension Plan* Sections**

### **Section 113.1**

#### **Factors to be considered**

**(4)** In conducting any review required by this section and in making any recommendations, ministers shall consider

...

(d) the financing objective, for the additional Canada Pension Plan, of having additional contribution rates, without taking into account the changes, if any, referred to in paragraph (e) for which the additional contribution rates most recently calculated under subparagraphs 115(1.1)(d)(ii) and (e)(ii) exceed zero, that are no lower than the rates

(i) that, beginning with the year 2024, are the lowest constant rates that can be maintained over the foreseeable future, and

(ii) that result in projected contributions and investment income that are sufficient to fully pay the projected expenditures of the additional Canada Pension Plan over the foreseeable future;

#### **Deemed changes to rates – additional Canada Pension Plan**

(11.141) Subject to subsection (11.143), if, at October 1 of the year before a three-year period for which a review is required by subsection (1), any of the following conditions is met, Schedule 2 is deemed to have been amended as of the next day after that October 1 to change the first additional contribution rates or second additional contribution rates for each year after that October 1, if required, in accordance with the calculations set out in the regulations:

- (a) the difference obtained by subtracting the first additional contribution rate specified in the most recent report prepared for the purpose of subsection 115(1) from the first additional contribution rate for self-employed persons set out in Schedule 2, for the year after that October 1, is within a range set out in the regulations for the purpose of this paragraph;
- (b) the following differences are within the same range set out in the regulations for the purpose of this paragraph:
  - (i) the difference obtained by subtracting the first additional contribution rate specified in the most recent report prepared for the purpose of subsection 115(1) from the first additional contribution rate for self-employed persons set out in Schedule 2, for the year after that October 1, and
  - (ii) the difference obtained by subtracting the first additional contribution rate specified in the report prepared for the purpose of section 115 that precedes the report referred to in subparagraph (i), from the first additional contribution rate for self-employed persons set out in Schedule 2, for the year that is two years before that October 1;
- (c) the difference obtained by subtracting the second additional contribution rate specified in the most recent report prepared for the purpose of subsection 115(1) from the second additional contribution rate for self-employed persons set out in Schedule 2, for the year after that October 1, is within a range set out in the regulations for the purpose of this paragraph; or
- (d) the following differences are within the same range set out in the regulations for the purpose of this paragraph:



- (i) the difference obtained by subtracting the second additional contribution rate specified in the most recent report prepared for the purpose of subsection 115(1) from the second additional in Schedule 2, for the year after that October 1, and
- (ii) the difference obtained by subtracting the second additional contribution rate specified in the report prepared for the purpose of section 115 that precedes the report referred to in subparagraph (i), from the second additional contribution rate for self-employed persons set out in Schedule 2, for the year that is two years before that October 1.

### **Determination of benefits – additional Canada Pension Plan**

**(11.142)** Subject to subsection (11.143), if, at October 1 of the year before a three-year period for which a review is required by subsection (1), any of the conditions set out in paragraphs (11.141)(a) to (d) is met, the portions of benefits under this Act in respect of the additional Canada Pension Plan for each year after that October 1, shall be determined in accordance with the regulations.

### **Non-application of subsections (11.141) and (11.142)**

**(11.143)** Subsections (11.141) and (11.142) do not apply if

- (a) a recommendation was made under subsection (1) in the three years before the three-year period referred to in subsection (11.141) that the first additional contribution rates or second additional contribution rates for one or more of the years in that three-year period be changed and the rates were changed before October 1 of the year before that three-year period, by an Act of Parliament or by a regulation made under subsection (6), to give effect to that recommendation; or
- (b) a recommendation was made under subsection (1) in the three years before the three-year period referred to in subsection (11.141) that the first additional contribution rates or second additional contribution rates for the years in that three-year period not be changed and the Minister of Finance before October 1 of the year before that three-year period has caused that recommendation to be published in the *Canada Gazette*.

## **Section 115**

### **Contents of report**

(1.1) The Chief Actuary shall, in the report,

...

- (d) in respect of the additional Canada Pension Plan, specify a first additional contribution rate calculated, in respect of self-employed persons for each year of a period of not less than 75 years after the three-year period in which the report is prepared, by combining
  - (i) a first additional contribution rate, calculated in the prescribed manner, without taking into account the changes, if any, referred to in paragraph 113.1(4)(e) for which the first additional contribution rate most recently calculated under subparagraph (ii) exceeds zero, and
  - (ii) a first additional contribution rate calculated in the prescribed manner in respect of the changes, if any, referred to in paragraph 113.1(4)(e) that affect the first additional contribution rate;
- (e) in respect of the additional Canada Pension Plan, specify a second additional contribution rate calculated, in respect of self-employed persons for each year of a period of not less than 75 years after the three-year period in which the report is prepared, by combining

- (i) a second additional contribution rate, calculated in the prescribed manner, without taking into account the changes, if any, referred to in paragraph 113.1(4)(e) for which the second additional contribution rate most recently calculated under subparagraph (ii) exceeds zero, and
- (ii) a second additional contribution rate calculated in the prescribed manner in respect of the changes, if any, referred to in paragraph 113.1(4)(e) that affect the second additional contribution rate

## **Appendix C – Adjustment Mechanisms in Social Security Systems: Ontario Retirement Pension Plan, OECD Countries**

### ***Ontario Retirement Pension Plan (ORPP)***

Under the *Ontario Retirement Pension Plan Act (Strengthening Retirement Security for Ontarians), 2016*, a Sustainability Contribution Rate Differential (SCRD) was defined as the difference of the Total Contribution Rate less the Sustainability Rate. The Total Contribution Rate referred to the current employer-employee combined rate payable and the Sustainability Rate was defined in the legislation as “the lowest total contribution rate, determined in accordance with the regulations, that, if implemented three years after the day after the valuation date, would be projected to result in the ORPP being able to satisfy its obligations, as they become due, for 100 years after the valuation date”.

The ORPP was defined to (a) have a funding shortfall if the SCRD was less than or equal to -0.1%, (b) be sustainable if the SCRD was between -0.1% and +0.1%, and (c) have a funding excess if the SCRD was greater than or equal to +0.1%. The adjustments that could be taken in the case of a funding shortfall or excess, in accordance with the provisions of the ORPP Act, are described in the *Ontario Retirement Pension Plan Actuarial Funding Report as at January 1, 2018*, prepared by Willis Towers Watson. The adjustments are described as follows.

In the case of a funding shortfall, the following steps could be taken: (1) first reverse any previous amendments, in whole or in part, made to address one or more previous excesses; (2) reduce the increase in the Maximum Annual Earnings Threshold<sup>11</sup> by no more than 10% and reduce the increase in the pension index by no more than 25%, subject to a ratio of 2 to 5 being kept between the former and latter reductions; (3) if actions (1) and (2) do not result in the SCRD rising above -0.1%, then increase the contribution rate. Benefits in pay can only be adjusted through their indexation.

In the case of a funding excess where the SCRD is no higher than 1.0%, one or more of the following actions could be taken: reverse any previous amendments, in whole or in part, made to address one or more previous shortfalls, decrease the Total Contribution Rate, or maintain the funding excess. If the SCRD exceeded 1.0%, then the ORPP Administration Corporation would be required to provide recommendations to the Ontario Government on how to reduce the SCRD to 1.0%. If the Government did not decide on the recommendations within a prescribed time period, then any previous amendments made in respect of shortfalls would be reversed, in whole or in part, and/or the contribution rate would be reduced such that the SCRD equaled 1.0%.

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<sup>11</sup> Contributions are made on earnings above \$3,500 up to the Maximum Annual Earnings Threshold.

## ***OECD Countries***

Automatic adjustment mechanisms of social security systems exist in various forms among countries in Europe and elsewhere. Although varying in elements of design and purpose, what is common among the various mechanisms is the goal of mitigating, at least to a certain degree, pressures on the social security systems arising from demographic and economic developments.

Many countries have addressed in particular the impact of continual increases in longevity on their social security systems through some form of life expectancy indexation, whereby the first eligible age to receive a retirement pension, the amount of the pension, or some combination of the two are linked to increases in life expectancy. Countries that have such automatic indexing mechanisms include Denmark, France, the United Kingdom, Italy, Spain, and Poland.

For other countries, the automatic adjustment mechanisms in their social security systems target more directly the sustainability of the systems by taking into account changes in various demographic and economic variables. Three countries with such sustainability mechanisms in place are Germany, Japan, and Sweden. The sustainability mechanisms of these three countries are described briefly below.

### **Germany**

In Germany, the public pension system is an earnings-related pay-as-you-go one, with additional means-tested benefits available from social assistance if needed. Pensions are determined based on earned pension points. The statutory retirement age is set to gradually increase to reach 67 within the next two decades (starting from 2012).

Since 2005, the growth in average benefits has been limited by the use of a sustainability factor. This factor incorporates the effects from factors that affect the dependency ratio (ratio of pensioners to contributors) including changes in life expectancy, migration, birth rates, labour force participation rates, and retirement rates. The sustainability factor offsets one quarter of the percentage increase in the dependency ratio. In addition, there could be an upward or downward adjustment to the payroll taxes depending on the value of the so-called liquidity reserve.

### **Japan**

In Japan, the public pension system consists of a basic, flat-rate scheme, an earnings-related plan (employees' pension scheme), as well as social assistance benefits. The rapid aging of Japan places pressure on the sustainability of its public system, and as a result there has been political intervention to restore solvency.

The automatic adjustment mechanism, referred to as "modified indexation", was implemented to restore solvency of the system without further political intervention. Since 2004, under this mechanism, the growth in the initial pension is automatically adjusted by a reduction factor. The reduction factor accounts for both the expected increase in life expectancy at age 65 (fixed at 0.3% per year) and the decline in the workforce. This reduction is applied to the regular indexing of benefits to obtain modified indexation, which will continue until financial solvency is expected to be achieved. Thereafter, normal indexation of benefits (in line with growth of disposable income) would resume. A goal of the system is to keep the contribution rate at 18.3% for 2017 and thereafter. There is also a

minimum benefit provision for the adjustment, such that if the replacement rate falls to 50% or lower during the adjusted indexation period, then the adjusted indexation is stopped and a review of the policy is undertaken.

## **Sweden**

In Sweden, the national retirement pension consists of a pay-as-you-go notional accounts system and a mandatory funded defined contribution pension with an income-tested defined benefit pension top-up. At retirement, the accumulated notional capital is converted to an annuity using a coefficient that depends on the retirement age and life expectancy without future mortality improvements after age 65.

The adjustment mechanism has two goals: (1) to maintain a constant contribution rate at 16%, and (2) to automatically restore the financial balance of the system without intervention from politicians. The automatic balancing mechanism is such that if assets (the buffer fund plus the contribution asset<sup>12</sup>) fall below liabilities (accrued notional pension capital and present value of benefits in pay), then both the indexation of pensions in pay and the returns credited to notional accounts are reduced by the “balance ratio” of assets to liabilities. The adjustment thus both lowers the accrual of future benefits and the amount of benefits in pay. Contributions are not affected. If the mechanism is triggered but later deemed unnecessary due to improved conditions, benefit accruals will be restored to their value prior to the adjustment and unadjusted pension indexation is resumed.

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<sup>12</sup> For the explanation of the “contribution asset” the reader is referred to the OCA’s Actuarial Study No. 10: *Measuring the Financial Sustainability of the Canada Pension Plan*.

## **Appendix D – Stochastic Analysis Model and Generated Distributions of Real Rates of Returns**

The model used to stochastically generate real rates of return is based on the model to perform the investment sensitivity tests for the 27<sup>th</sup> CPP Actuarial Report.

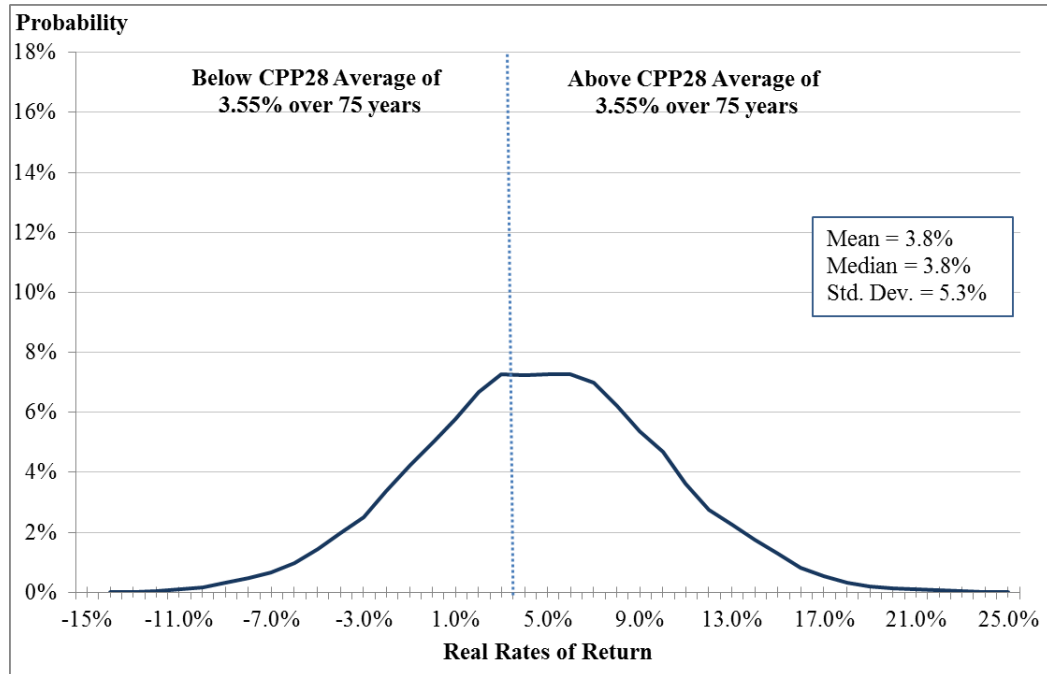
Stochastic modeling techniques estimate the probability distribution of an outcome for each selected variable, and these distributions are then used to quantify ranges of possible outcomes. For the purpose of this paper, the distribution of the real rate of return on investments was defined.

Under CPP28 and CPP29, an ultimate real rate of return on investments for the additional CPP of 3.6% net of investment expenses has been assumed for the best-estimate projections. The ultimate real rate of return assumption combined with the ultimate price increase assumption of 2.0% yields an assumed ultimate nominal annual rate of return of 5.6% for years 2025 and thereafter. During the initial years of the projection period, the real rate of return is assumed to gradually rise to its ultimate level.

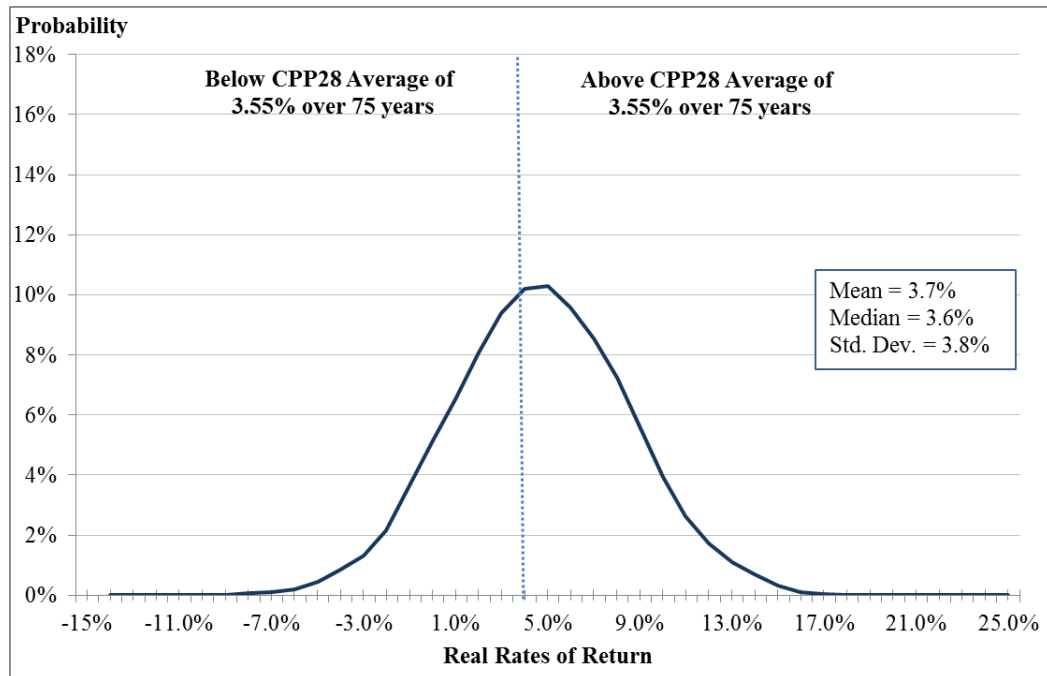
A stochastic approach was used to generate 10,000 possible paths of real rates of return over a 22-year projection period. The real rates of return of each asset class considered in CPP28 (and CPP29) (Canadian, foreign developed market and emerging market equities, bonds, short-term, real estate and infrastructure) are modelled using normal distributions. The means of these normal distributions are the best-estimate rates of return assumed for CPP28. Furthermore, the best estimates of the standard deviations and correlations between assets classes are used. Under CPP28, the best-estimate average real rate of return of the portfolio over 75 years is 3.55% and the one-year standard deviation is 9.2%.

Randomly generated 10,000 paths of real rates of return are used to mimic potential investment experience. The investment experience was simulated for 3, 6, 9, 12 and 15 years since these periods represent the time between 2 to 6 subsequent actuarial valuations. The charts below illustrate the results of these simulations.

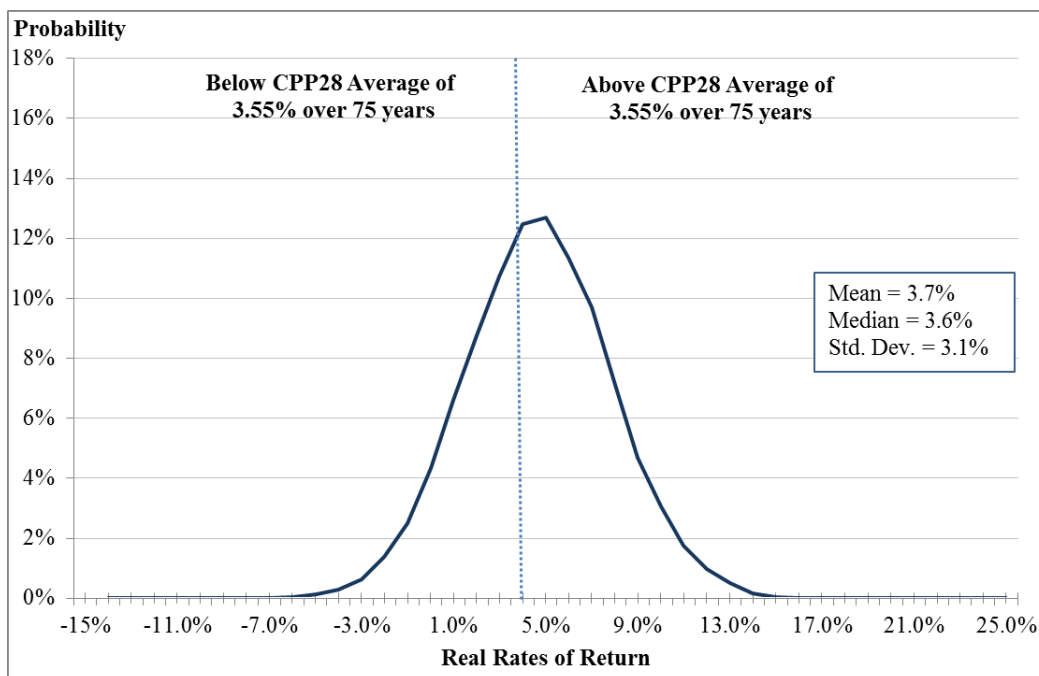
**Chart 15 Distribution of Average Real Rates of Return over 3 years**



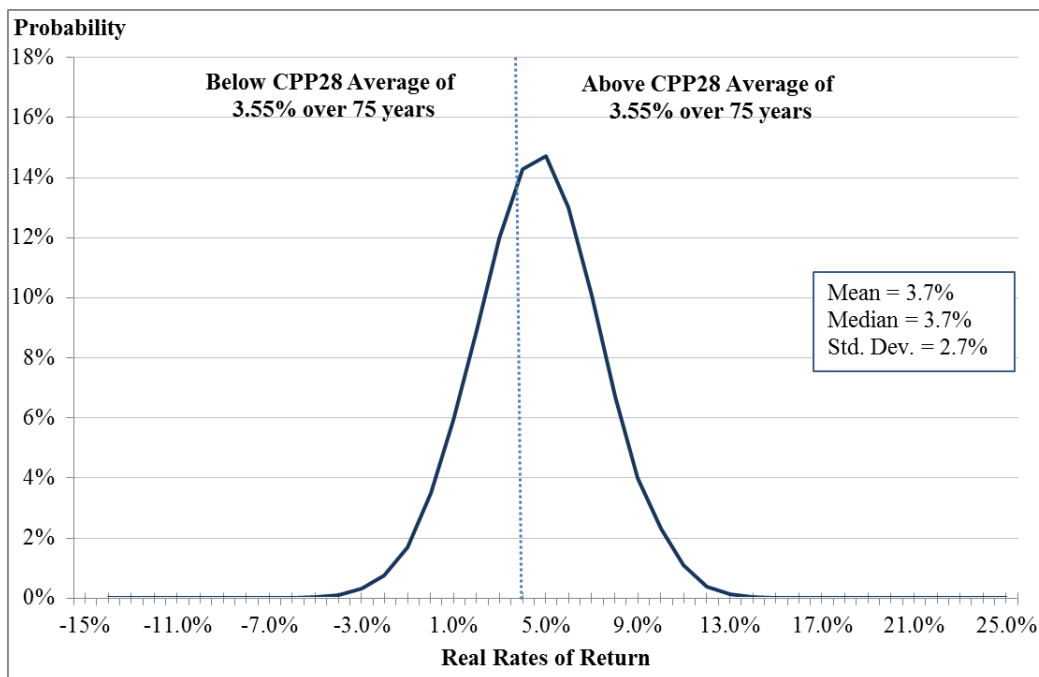
**Chart 16 Distribution of Average Real Rates of Return over 6 years**



**Chart 17 Distribution of Average Real Rates of Return over 9 years**

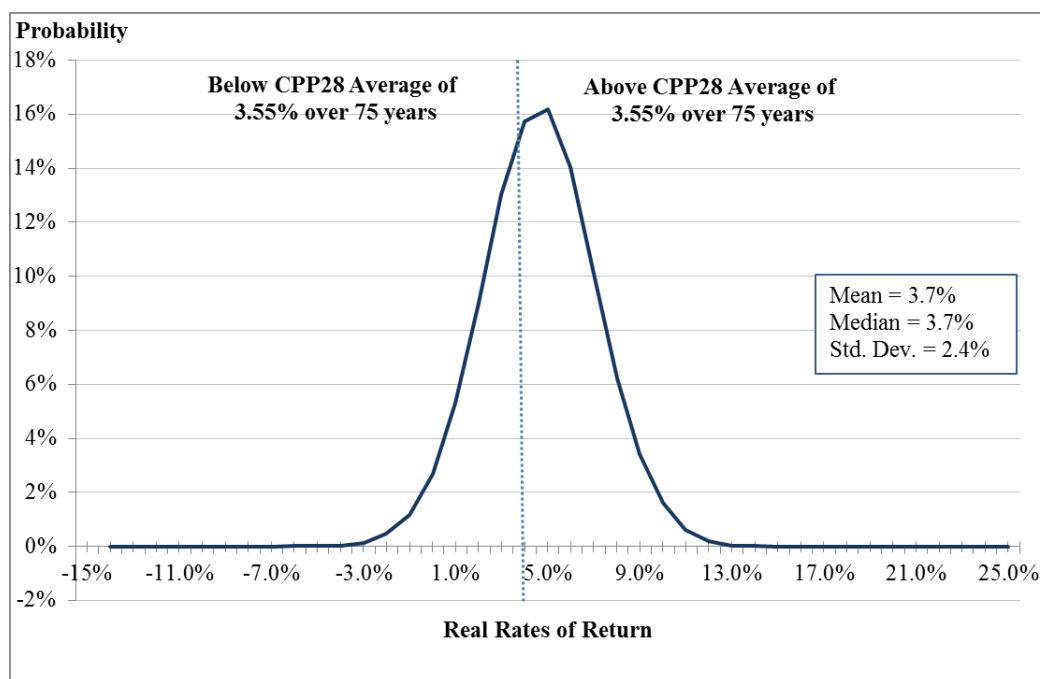


**Chart 18 Distribution of Average Real Rates of Return over 12 years**





**Chart 19 Distribution of Average Real Rates of Return over 15 years**



The expenditures and contributory earnings projected under the best-estimate assumptions of CPP29 together with the stochastically generated value of assets at the chosen valuation date are used to calculate the AMCRs. Thus, for each scenario, 10,000 combinations of the FAMCR and SAMCR are produced. This allows for the determination of the distributions of the AMCRs as a function of investment experience.

The model uses the best-estimate assumptions of CPP29 for all years in the projection period except for the years where the investment experience is simulated. For example, if the date of the actuarial valuation is 31 December 2045, then simulated paths of real rates of returns would be used for years 2043, 2044, and 2045 with a reversion to the best-estimate assumption for years 2046 and thereafter. It can be argued that particular investment experience may result in a changed investment outlook and, as such, a change in actuarial assumptions. However, for simplicity, it was assumed that the current best-estimate assumption of the real rate of return is maintained in the future.

## **Appendix E – Application of the Additional CPP Sustainability Provisions in the Case Where Temporary Contribution Rates are Not Equal to Zero**

Under paragraph 113.1(4)(e) of the *Canada Pension Plan*, changes to the base and additional CPP that increase benefits or add new benefits should be accompanied by a permanent increase in the contribution rates to cover future cost of such benefits, and by a temporary increase in the rates to cover the cost associated with past liabilities related to such benefits. The additional CPP Sustainability Regulations provide for the special case where the temporary rates as calculated under subparagraphs 115(1.1)(d)(ii) and (e)(ii) of the *Canada Pension Plan* are not equal to zero. It should be noted that such special case is only relevant in the case of deficit. The additional CPP Sustainability Regulations address two possible scenarios when there are non-zero temporary contribution rates.

Under the first scenario, the application of the additional CPP Sustainability Regulations is triggered solely by the temporary component of the AMCRs defined by subparagraphs 115(1.1)(d)(ii) and (e)(ii), i.e. the actions of the Regulations would not be required if these temporary contribution rates were determined to be equal to zero. This case is covered by subsection 3(3) of the Regulations which prescribes the deemed temporary increases to the additional contribution rates such that the resulting deemed additional contribution rates are equal to the sum of the legislated and temporary contribution rates. The following provides an example of the application of subsection 3(3).

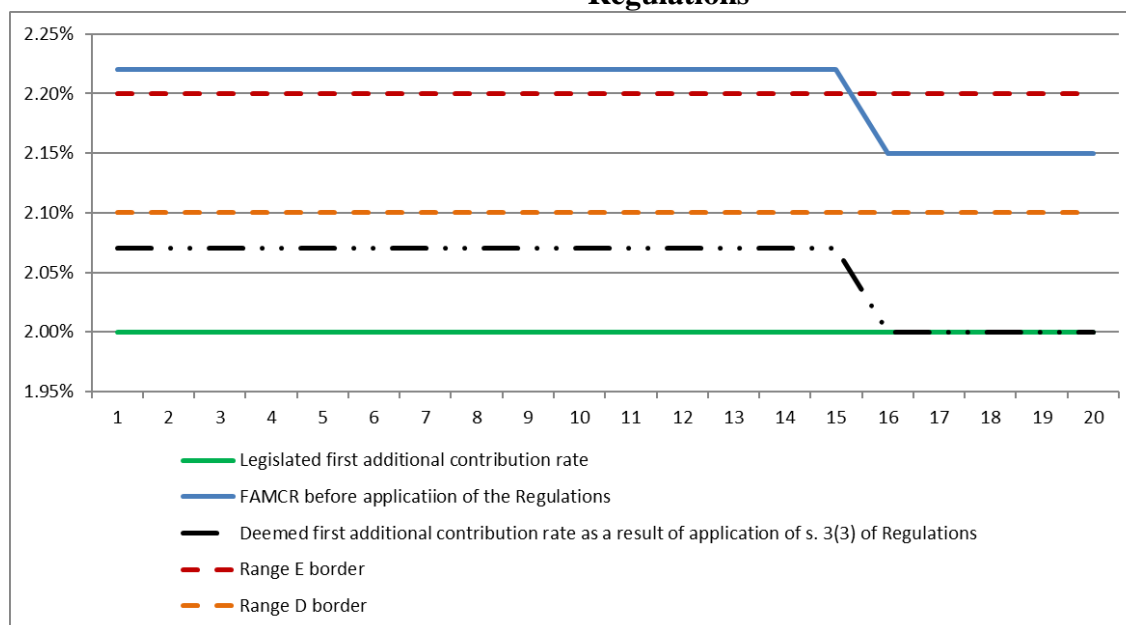
### **Example**

It is assumed that at the valuation date the deemed first additional contribution rate is equal to the legislated rate of 2.0% (green line in Chart 20) and the FAMCR is determined to be 2.22% for the first 15 years following the end of the triennial review (years 1 to 15 of the horizontal axis of Chart 20) and 2.15% thereafter (shown by the blue line in Chart 20), i.e. the temporary contribution rate is equal to 0.07% (2.22% - 2.15%) for years 1 to 15.

Since the FAMCR falls into the “immediate action” range E only for the years 1 to 15, subsection 3(3) of the Regulations will apply. As a result, the first additional contribution rate will be deemed to increase by the temporary rates of 0.07% for 15 years.

The resulting deemed first additional contribution rates will be 2.07% for 15 years and 2.0% thereafter (black dashed line in Chart 20).

**Chart 20 Example of the Application of Subsection 3(3) of the Additional CPP Sustainability Regulations**



Under the second scenario, the application of the additional CPP Sustainability Regulations are triggered even if the temporary rates determined under subparagraphs 115(1.1)(d)(ii) and (e)(ii) of the *Canada Pension Plan* were equal to zero.

In such situation, the following actions are applied:

- In determining the extent of the reduction in benefits, all benefits that give rise to non-zero temporary rates are excluded (paragraphs 11(1)(a), 12(1)(a) and 12(2)(a) of the additional CPP Sustainability Regulations);
- In determining the extent of the reduction of benefits, any past deemed temporary increases to contribution rates resulting from the operation of the additional CPP Sustainability Regulations are also excluded (chapeau of subsections 11(1), 12(1) and 12(2) of the Regulations); and
- After the required reductions in benefits are determined, the deemed additional contribution rates are temporarily increased by adding the temporary rates needed to finance the benefits excluded under the first bullet (subsections 11(3) and 12(5) of the Regulations).

Example below illustrates the application of the additional CPP Sustainability Regulations in such a situation.

### Example

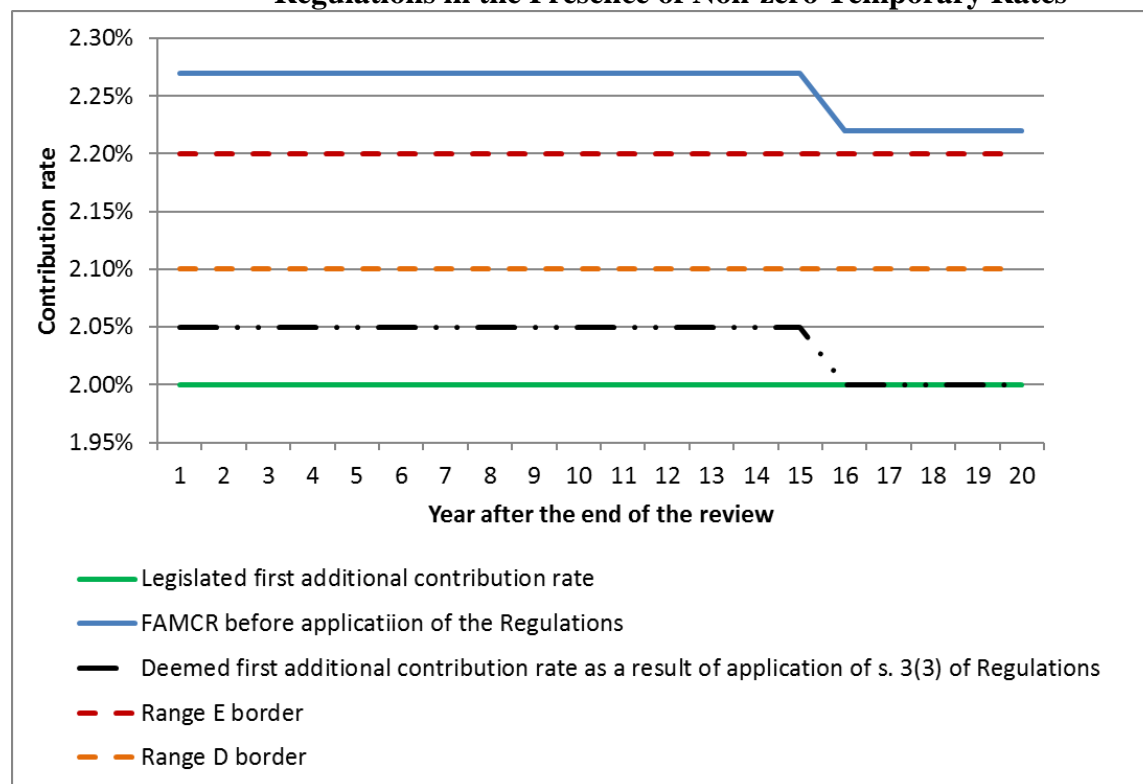
It is assumed that at the valuation date the deemed first additional contribution rate is equal to the legislated rate of 2.0% (green line in Chart 21) and that the FAMCR is determined to be 2.27% for the first 15 years following the end of the triennial review (years 1 to 15 of the horizontal axis of Chart 21) and 2.22% thereafter (shown by the blue line in Chart 21), i.e. the temporary contribution rate is equal to 0.05% (2.27% - 2.22%) for years 1 to 15.

The reduction in benefits under section 11(1) of the Regulations is determined without taking into account the benefits that gave rise to the temporary contribution rates of 0.05%. It is assumed that the

final target benefit multiplier determined as a result of the application of section 11(1) is equal to 0.95. Further, it is assumed that subsection 11(2) does not apply. However, under subsection 11(3), there should be a deemed temporary change to the contribution rates for the first 15 years following the end of review. This deemed temporary rate is determined to be equal 0.0475% ( $= 0.05\% * 0.95$ ) rounded to 0.05%.

As a result, the deemed first additional contribution rates are 2.05% for 15 years and 2.0% thereafter (black dashed line).

**Chart 21 Example of the Application of Section 11 of the Additional CPP Sustainability Regulations in the Presence of Non-zero Temporary Rates**



## Appendix F – Illustrations of the Application of the Additional CPP Sustainability Regulations

The following illustrations assume that the inflation assumed by the Chief Actuary for the purpose of the actuarial valuations is the same as actual inflation and is equal to 2% per year.

### 1. Illustrations of the Application of the Additional CPP Sustainability Regulations in Case of Surplus

Table 20 provides six illustrative scenarios of the application of the additional CPP Sustainability Regulations in the case of surplus. These illustrations should be read together with Chart 8.

**Scenario A.** Under this scenario, there were both a previous reduction in benefits (indexation was reduced by 10% and benefit multipliers (BMs) were applied) and a deemed increase in the additional contribution rates (the first additional contribution rate (FACR) was deemed to increase from 2.0% to 2.1%). Assuming inflation of 2%, the interim and final target BMs, as defined by section 10 of the Regulations, are equal to 0.988 (based on 1.8% indexation instead of 2% for six years:  $0.988 = (1.018/1.02)^6$ ). The FAMCR is determined to be 1.7% and the deemed FACR is 2.1%.

As per Section 7(1) of the Regulations, the Chief Actuary sets S1 equal to 0.1 which corresponds to the restoration of the lost indexation of 10%. This brings the BM to 1, six years after the end of the review.

These actions increase the FAMCR from 1.7% to 1.8%. Since there is a deemed increase in the additional contribution rates and the AMCRs are lower than the deemed additional contribution rates (ACRs), section 7(2) is applied.

Under section 7(2), the FACR is reduced from 2.1% to 2.0%. However, the FAMCR (1.8%) is still lower than 1.9% (FACR – 10bps), so Section 7(3) needs to apply.

Under Section 7(3), the Chief Actuary determines that, over the 6 years following the end of the triennial review, further positive adjustment to benefits is needed to have the FAMCR equal to 1.9%. S2 is determined to be 0.1.

As a result, for the six years following the review, benefits in pay will be indexed at 120% of the CPI (combination of increases S1 and S2). The interim and final target benefit multipliers (defined by section 8 of the Regulations) at the end of the adjustment period will be equal to 1.012.

**Scenario B.** Scenario B is similar to Scenario A except that indexation was previously reduced by 20% (1.6% indexation instead of 2%) and the interim and final target BMs are equal to 0.977 (based on 1.6% indexation instead of 2% for six years:  $0.977 = (1.016/1.02)^6$ ). The FAMCR is determined to be 1.7% and the deemed FACR is 2.1%.

As per Section 7(1) of the Regulations, the Chief Actuary sets S1 equal to 0.2 which corresponds to the restoration of the lost indexation of 20%. This brings the BM to 1, six years after the end of the review.

These actions increase the FAMCR from 1.7% to 1.9%. Since there is a deemed increase in the additional contribution rates and the AMCRs are lower than the deemed additional contribution rates, Section 7(2) applies.

Under Section 7(2), the deemed first additional contribution rate is reduced from 2.1% to 2.0%. The FAMCR (1.9%) is now 10 bps lower than the legislated first additional contribution rate so no further actions are needed.

As a result, six years following the review, benefits in pay will be indexed at 120% of the CPI (increase as per S1). The interim and final target benefit multipliers (defined by section 8 of the Regulations) at the end of the adjustment period are equal to 1.

**Scenario C.** Scenario C is similar to Scenario A except that indexation was previously reduced by 30% (1.4% indexation instead of 2%), and the interim and final target BMs are equal to 0.965 (based on 1.4% indexation instead of 2% for six years:  $0.965 = (1.014/1.02)^6$ ). The FAMCR is determined to be 1.7% and the deemed FACR is 2.1%.

As per Section 7(1) of the Regulations, the Chief Actuary sets S1 equal to 0.3 which corresponds to the restoration of the lost indexation of 30%. This brings the BM to 1, six years after the end of the review.

These actions increase the FAMCR from 1.7% to 2.0%. Since there is a deemed increase in the additional contribution rates and the AMCRs are lower than the deemed additional contribution rates, Section 7(2) applies.

Under Section 7(2), the FACR is reduced from 2.1% to 2.0%. The FAMCR (2.0%) is now equal to the legislated rate, so no further actions are needed.

As a result, during six years following the review, benefits in pay will be indexed at 130% of the CPI (increase as per S1). The interim and final benefit multipliers (defined by section 8 of the Regulations) at the end of the adjustment period are equal to 1.

**Scenario D.** Under Scenario D, there were both a previous reduction in benefits (indexation was reduced by 40% and BMs were applied) and a deemed increase in the additional contribution rates (the FACR was increased from 2.0% to 2.1%). The interim and final target BMs are equal to 0.954 (based on 1.2% indexation instead of 2% for six years:  $0.954 = (1.012/1.02)^6$ ). The FAMCR is determined to be 1.6% and the deemed FACR is 2.1%.

As per Section 7(1) of the Regulations, the Chief Actuary sets S1 equal to 0.40 which corresponds to the restoration of the lost indexation of 40%. This brings the BM to 1, six years after the end of the review.

These actions increase the FAMCR from 1.6% to 2.1%. Therefore the FAMCR is equal to the deemed first additional contribution rate and no further actions are needed.

As a result, during six years following the review, benefits in pay will be indexed at 140% of the CPI (increase as per S1). The interim and final target benefit multipliers (defined by section 8 of the Regulations) at the end of the adjustment period are equal to 1.

**Scenario E.** Under Scenario E, there are both a previous reduction in benefits (indexation was reduced by 40% and BMs were applied) and a deemed increase in the additional contribution rates (the FACR was increased from 2.0% to 2.1%). The interim and final target BMs were equal to 0.954 (based on 1.2% indexation instead of 2% for six years:  $0.954 = (1.012/1.02)^6$ ). The FAMCR is determined to be 1.7% and the deemed FACR is 2.1%.

As per Section 7(1) of the Regulations, the Chief Actuary needs to determine S1 to fully or partially reverse previous decreases in benefits. However, in this case benefits cannot be fully restored.

Therefore, the Chief Actuary sets  $S1$  equal to 0.35 which corresponds to the partial restoration of the lost indexation of 40%. This brings the BMs to 0.994, six years after the end of the review.

These actions result in the FAMCR being equal to the deemed FACR of 2.1%, so no further actions are needed.

As a result, during six years following the review, benefits in pay will be indexed at 135% of the CPI (increase as per  $S1$ ). The interim and final target benefit multipliers (defined by section 8 of the Regulations) at the end of the adjustment period are equal to 0.994.

**Scenario F.** Under Scenario F, there were no previous adjustments to benefits or contribution rates. The FAMCR is determined to be 1.7% and the deemed FACR is equal to the legislated rate of 2.0%. Therefore section 5 of the Regulations applies.

In this scenario,  $S2$  is determined to be equal to 0.2 resulting in the FAMCR equal to 1.9% (10 bps lower than its legislated value of 2.0%). The period of adjustment is set to 6 years.

As a result, six years following the review, benefits in pay will be indexed at 120% of the CPI (increase as per  $S2$ ). The interim and final target benefit multipliers (defined by section 8 of the Regulations) at the end of the adjustment period are equal to 1.024.

**Table 20 Illustrations of the Application of the Additional CPP Sustainability Regulations in Case of Surplus (should be read together with Chart 8)**

Parameters	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E	Scenario F
Deemed FACR (Regs.)	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%
FAMCR	1.7%	1.7%	1.7%	1.6%	1.7%	1.7%
Cost of previous reductions in benefits	10 bps	20 bps	30 bps	50 bps	50 bps	0 bps
How much indexation was given (% of CPI)	90%	80%	70%	60%	60%	100%
Difference between FACR and FAMCR	40 bps	40 bps	40 bps	50 bps	40 bps	30 bps
Box 1, Question 1: Were there any previous reductions in benefits and/or deemed increases in contribution rates?	YES	YES	YES	YES	YES	NO
<b>Action 1</b>	Reverse previous reduction in benefits as per Section 7					Improve benefits as per Section 5
Deemed FACR after Action 1	2.1%	2.1%	2.1%	2.1%	2.1%	2.0%
FAMCR after Action 1 (Sec. 7 (1))	1.8%	1.9%	2.0%	2.1%	2.1%	1.9%
Additional indexation (Sec. 7(1))	S1 = 0.1	S1 = 0.2	S1 = 0.3	S1 = 0.4	S1 = 0.35	S2 = 0.2
BOX 2 Question 2: After application of section 7(1) are the AMCRs equal to the deemed additional contribution rates?	NO	NO	NO	YES	YES	
<b>Action 2</b>	Reduce deemed ACRs as per Section 7(2)			No Action		
Deemed FACR after Action 2	2.0%	2.0%	2.0%	2.1%	2.1%	
FAMCR after Action 2	1.8%	1.9%	2.0%	2.1%	2.1%	
BOX 5 Question 3: Is FAMCR at or above legislated rate minus 10 bps?	NO	YES	YES			
<b>Action 3</b>	Increase benefits as per Sec. 7(3)	No Action	No Action			
Indexation applied for 6 years (% of CPI)	120%	120%	130%	140%	135%	120%
Deemed FACR after Actions 1 to 3	2.0%	2.0%	2.0%	2.1%	2.1%	2.0%
FAMCR after Actions 1 to 3	1.9%	1.9%	2.0%	2.1%	2.1%	1.9%

*NOTE: all adjustments are expected to be made over 6 years unless specified otherwise.*



## 2. Illustrations of the Application of the Additional CPP Sustainability Regulations in the Case of Deficit

Table 21 provides six illustrative scenarios of the application of the additional CPP Sustainability Regulations in the case of deficit. These examples should be read together with Chart 9. Under all examples, contributions are determined using legislated additional contribution rates.

**Scenario A.** Under this scenario, there was a previous increase in benefits over 6 years (indexation was increased by 20% and BMs were applied). The interim and final target BMs are equal to 1.024 (based on 2.4% indexation instead of 2% for six years:  $1.024 = (1.024/1.02)^6$ ). The FAMCR is determined to be 2.4%.

As per subsection 12(1) of the Regulations, the Chief Actuary sets S3 equal to -0.2 which corresponds to the reversal of the additional indexation of 20%. This brings the benefit multiplier to 1 after six years following the end of the review period.

These actions decrease the FAMCR from 2.4% to 2.3%. Since it remains higher than the FACR, subsection 12(2) needs to apply.

Under subsection 12(2), the Chief Actuary further determines that, over the 6 years following the end of the triennial review, further negative adjustment to benefits are needed. S4 is determined to be equal to -0.4, the minimum possible value of S4. Since  $S3 + S4 = -0.6 \geq -1$ , no recalculation of S3 is needed under subsection 12(3).

These actions bring the FAMCR to 2.1%, which is still higher than the FACR of 2.0%. The interim and target BMs determined under section 13 of the Regulations, six years after the end of the review are equal to 0.954.

Since  $S4 = -0.4$  and the FAMCR is still higher than the FACR, subsection 12(4) of the Regulations will apply, and the FACR will be deemed to increase to 2.1% to be equal to the FAMCR.

As a result, during six years following the review, benefits in pay will be indexed at 40% of the change in the CPI (combination of reductions S3 and S4). The interim and final target BMs at the end of the adjustment period are equal to 0.954. Starting from the first year following the end of the review period, the deemed first and second additional contribution rates will be equal to 2.1% and 8.4%, respectively.

**Scenario B.** Scenario B is similar to Scenario A except that indexation was previously increased by 70% (assuming inflation of 2%, 3.4% indexation instead of 2%) and interim and final BMs are equal to 1.085 (based on 3.4% indexation instead of 2% for six years:  $1.085 = (1.034/1.02)^6$ ) was applied. The FAMCR is determined to be 2.6%.

As per subsection 12(1) of the Regulations, the Chief Actuary sets S3 equal to -0.7 which corresponds to the reversal of the additional indexation of 70%. This brings the BM to 1, six years after the end of the review.

These actions decrease the FAMCR from 2.60% to 2.25%. Since it remains higher than the FACR, subsection 12(2) needs to apply.

Under subsection 12(2), the Chief Actuary further determines that, over the 6 years following the end of the triennial review, further negative adjustment to benefits is needed. S4 is determined to be equal to -0.4, the minimum possible value of S4. These actions decrease further the FAMCR to 2.05%.

Since  $S3 + S4 = -1.3 < -1$ ,  $S3$  needs to be recalculated according to subsection 12(3) of the Regulations. The Chief Actuary determines an alternative  $S3 = -0.5$  that would apply over 9 years. The FAMCR remains at 2.05%. As per section 13 of the Regulations, the interim target BM, six years after the end of the review will be equal to 0.975, and the final target BM nine years after the end of the review will be equal to 0.947.

Since  $S4 = -0.4$  and the FAMCR is still higher than the FACR, subsection 12(4) applies, and the FACR is deemed to be increased to 2.05% to be equal to the FAMCR.

As a result, during six years following the review, benefits in pay will be indexed at 10% of the change in the CPI (reduction as per  $S3$  and  $S4$ ) and during the next 3 years at 50% (reduction as per  $S3$ ). The interim target BM six years following the end of the review will be equal to 0.975, and the final target BM nine years following the end of the review will be equal to 0.947. Starting from the first year following the end of the review period, the deemed first and second additional contribution rates will be equal to 2.05% and 8.2%, respectively.

**Scenario C.** Under Scenario C, the indexation was previously increased by 40% (assuming inflation of 2%, 2.8% indexation instead of 2%) and the interim and final target BMs are 1.048 (based on 2.8% indexation instead of 2% for six years:  $1.048 = (1.028/1.02)^6$ ) was applied. The FAMCR is determined to be 2.3%.

As per subsection 12(1) of the Regulations, the Chief Actuary sets  $S3$  equal to -0.4 which corresponds to the reversal of the additional indexation of 40%. This brings the BM to 1, six years following the end of the review.

As a result of these actions the FAMCR is equal to 2.1%. Since it remains higher than the FACR, subsection 12(2) applies.

Under subsection 12(2), the Chief Actuary further determines that, over the 6 years following the end of the triennial review, further negative adjustment to benefits is needed.  $S4$  is determined to be equal to -0.2. Since  $S3 + S4 = -0.6 \geq -1$ , no recalculation of  $S3$  is needed. These actions further decrease the FAMCR to 2.0% and no further actions are needed.

As a result, during the six years following the review, benefits in pay will be indexed at 40% of the change in the CPI (reduction as per  $S3$  and  $S4$ ). The interim and final target BMs at the end of the adjustment period are equal to 0.976.

**Scenario D.** Under Scenario D, indexation was previously increased by 60% (assuming inflation of 2%, 3.2% indexation instead of 2%) and the interim and final target BMs are 1.073 (based on 3.2% indexation instead of 2% for six years:  $1.073 = (1.032/1.02)^6$ ) was applied. The FAMCR is determined to be 2.3%.

As per subsection 12(1) of the Regulations, the Chief Actuary sets  $S3$  equal to -0.6 which corresponds to the reversal of the additional indexation of 60%. This brings the BM to 1, six years after the end of the review.

As a result of these actions, the FAMCR is equal to 2.0%. Since it is the same as the FACR, no further actions are needed.

As a result, during six years following the review, benefits in pay will be indexed at 40% of the change in the CPI (reduction as per  $S3$ ). The interim and final target BMs six years following the end of the review are equal to 1.0 (as per sections 13 of the Regulations).

**Scenario E.** Under Scenario E, there were no previous adjustments to benefits. So subsection 11(1) of the Regulations applies. The FAMCR is determined to be 2.2%.

As per subsection 11(1) of the Regulations, the Chief Actuary sets  $S_4$  to be to -0.4. This brings the BM to 0.954 six years following the end of the review.

As a result of these actions, the FAMCR is equal to 2.0%. Since it is the same as the FACR, no further actions are needed.

The interim and final target BMs at the end of the adjustment period are equal to 0.954 (as per section 13 of the Regulations).

**Scenario F.** Under Scenario F, there were no previous adjustments to benefits. The FAMCR is determined to be 2.2%.

As per subsection 11(1) of the Regulations, the Chief Actuary sets  $S_4$  to be to -0.4. This brings the BM to 0.954, six years following the end of the review.

As a result of these actions, the FAMCR is equal to 2.1%. Since it is higher than the FACR, subsection 11(2) applied and the FACR is deemed to increase from 2.0% to 2.1%.

As a result, during six years following the review, benefits in pay will be indexed at 60% of the CPI (reduction as per  $S_4$ ). The interim and final target BMs at the end of the adjustment period are equal to 0.954 (as per section 13 of the Regulations). Starting from the first year following the end of the review period, the deemed first and second additional contribution rates will be equal to 2.1% and 8.4%, respectively.

**Table 21 Illustrations of the Application of the Additional CPP Sustainability Regulations  
 in Case of Deficit (should be read together with Chart 9)**

Parameters	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E	Scenario F
Deemed FACR (as per Regulations)	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
FAMCR	2.40%	2.60%	2.30%	2.30%	2.20%	2.30%
Cost of previous incr. in benefits	10 bps	35 bps	20 bps	30 bps	0 bps	0 bps
How much indexation was given (% of CPI)	120%	170%	140%	160%	0%	0%
Diff. between FACR and FAMCR	40 bps	60 bps	30 bps	30 bps	20 bps	30 bps
Question 1: Were there any previous increases in benefits?	YES	YES	YES	YES	NO	NO
Action 1	Reverse previous increases in benefits as per subsection 12(1)				Reduce benefits as per subsection 11(1)	
Deemed FACR after Action 1	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
FAMCR after Action 1	2.30%	2.25%	2.10%	2.00%	2.00%	2.10%
Reduction in indexation	S3 = -0.2	S3 = -0.7	S3 = -0.4	S3 = -0.6	S4 = -0.4	S4 = -0.4
BOX 2 Question 2: After application of subsection 12(1) are the AMCRs equal to the deemed additional contribution rates?	NO	NO	NO	YES		
BOX 3 Question 5: After application of subsection 11(1) are the AMCRs equal to the deemed additional contribution rates?					YES	NO
Action 2	Reduce benefits as per subsection 12(2)			No Action	No Action	Deemed increase to additional contribution rates as per subsection 11(2)
Deemed FACR after Action 2	2.00%	2.00%	2.00%			2.10%
FAMCR after Action 2	2.10%	2.05%	2.00%			2.10%
Reduction in indexation	S4 = -0.4	S4 = -0.4	S4 = -0.2			S4 = -0.4
BOX 5 Question 3: Is S3+S4 < -1	NO	YES	NO			

**Table 21 Continued**

<b>Action 3</b>	No action	Apply subsection 12(3)	No action			
Deemed FACR after Action 3	2.00%	2.00%	2.00%			2.10%
FAMCR after Action 3	2.10%	2.05%	2.00%			2.10%
Reduction in indexation	S3 = -0.2, S4 = -0.4	S3 = -0.5 for 9 years, S4 = -0.4 for 6 years	S3 = -0.4, S4 = -0.2			S4 = -0.4
<b>BOX 10 Question 4: After the previous actions are the AMCRs equal to the deemed additional contribution rates?</b>	NO	NO	YES			
<b>Action 4</b>	Deemed increase to additional contribution rates as per subsection 12(4)		No action			
Deemed FACR after Action 4	2.10%	2.05%	2.00%			2.10%
FAMCR after Action 4	2.10%	2.05%	2.00%			2.10%
<b>Indexation applied for 6/9 years (% of CPI)</b>	<b>40%</b>	<b>10%/50%</b>	<b>40%</b>	<b>40%</b>	<b>60%</b>	<b>60%</b>
<b>Deemed FACR after Actions 1 to 4</b>	<b>2.10%</b>	<b>2.05%</b>	<b>2.00%</b>	<b>2.00%</b>	<b>2.00%</b>	<b>2.10%</b>
<b>FAMCR after Actions 1 to 4</b>	<b>2.10%</b>	<b>2.05%</b>	<b>2.00%</b>	<b>2.00%</b>	<b>2.00%</b>	<b>2.10%</b>

*NOTE: all adjustments are expected to be made over 6 years unless specified otherwise.*

## Appendix G – Bibliography

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## Appendix H – Acknowledgements

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