

ROYAL BANK OF CANADA  
Form 424B2  
December 31, 2018

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RBC Capital Markets® Filed Pursuant to Rule 424(b)(2)  
Registration Statement No. 333-227001

Pricing Supplement

Dated December 28,  
2018

To the Product \$2,245,000

Prospectus Supplement

No. CCBN-2, Dated Autocallable Contingent Coupon Barrier Notes with  
September 10, 2018, the Memory Coupon Linked to the S&P 500® Index, due

Prospectus Supplement January 15, 2020

Dated Royal Bank of Canada

September 7, 2018, and

the Prospectus Dated

September 7, 2018

Royal Bank of Canada is offering Autocallable Contingent Coupon Barrier Notes (the “Notes”) linked to the S&P 500 Index (the “Reference Index”). The Notes are our senior unsecured obligations, will pay a quarterly Contingent Coupon in the amounts and under the circumstances specified below, and will have the terms described in the documents described above, as supplemented or modified by this pricing supplement.

Reference Index	Initial Level	Trigger Level*	Coupon Barrier*
S&P 500® Index (“SPX”)	2,485.74	1,988.59, which is 80% of its Initial Level	1,988.59, which is 80% of its Initial Level

\*Rounded to two decimal places.

The Notes do not guarantee any return of principal at maturity. Any payments on the Notes are subject to our credit risk.

Investing in the Notes involves a number of risks. See “Selected Risk Considerations” beginning on page P-7 of this pricing supplement, and “Risk Factors” beginning on page PS-5 of the product prospectus supplement dated September 10, 2018 and page S-1 of the prospectus supplement dated September 7, 2018.

The Notes will not constitute deposits insured by the Canada Deposit Insurance Corporation, the U.S. Federal Deposit Insurance Corporation or any other Canadian or U.S. government agency or instrumentality. The Notes are not subject to conversion into our common shares under subsection 39.2(2.3) of the Canada Deposit Insurance Corporation Act. Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of the Notes or determined that this pricing supplement is truthful or complete. Any representation to the contrary is a criminal offense.

Issuer:	Royal Bank of Canada	Stock Exchange Listing:	None
Trade Date:	December 28, 2018	Principal Amount:	\$1,000 per Note
Issue Date:	January 3, 2019	Maturity Date:	January 15, 2020
Coupon Payment Dates:	Quarterly, as set forth below	Observation Dates:	Quarterly, as set forth below

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Valuation Dates:	January 6, 2020, January 7, 2020, January 8, 2020, January 9, 2020 and January 10, 2020	Contingent Coupon:	\$28.63 per \$1,000 in principal amount, if payable
Initial Level:	The closing level of the Reference Index on the Trade Date, as set forth in the above table.		
Final Level:	The arithmetic average of the closing level of the Reference Index on each of the Valuation Dates.		
Contingent Coupon and Memory Feature:	<p>If the Notes have not been previously called, and if the closing level of the Reference Index is greater than or equal to the Coupon Barrier on the applicable Observation Date (or the Final Level, in the case of the final Coupon Payment Date), we will pay the Contingent Coupon on the applicable Coupon Payment Date. You may not receive any Contingent Coupons during the term of the Notes.</p> <p>If a Contingent Coupon is not payable on any Coupon Payment Date, it will be paid on any later Coupon Payment Date (or at maturity) on which the Contingent Coupon is then payable, together with the payment otherwise due on that later date.</p> <p>If the Notes are not previously called, we will pay you at maturity an amount based on the Final Level:</p> <p>For each \$1,000 in principal amount, \$1,000 plus the Contingent Coupon (together with any previously unpaid Contingent Coupons) at maturity, unless the Final Level is less than the Trigger Level.</p> <p>If the Final Level is less than the Trigger Level, then the investor will receive at maturity, for each \$1,000 in principal amount, a cash payment equal to:  <math>\\$1,000 + (\\$1,000 \times \text{Underlying Return})</math></p> <p>Investors could lose some or all of their principal amount if the Reference Index decreases.</p>		
Payment at Maturity (if held to maturity):	<p>The Notes will be automatically called on any Coupon Payment Date (other than the final Coupon Payment Date) if the closing level of the Reference Index on the immediately preceding Observation Date is greater than or equal to the Initial Level, as described below.</p>		
Call Feature:	<p>The Notes will be automatically called on any Coupon Payment Date (other than the final Coupon Payment Date) if the closing level of the Reference Index on the immediately preceding Observation Date is greater than or equal to the Initial Level, as described below.</p>		
CUSIP/ISIN:	78013XVE5/US78013XVE56		

	Per Note	Total
Price to public	100.00%	\$2,245,000
Underwriting discounts and commissions <sup>(1)</sup>	1.00%	\$22,450
Proceeds to Royal Bank of Canada	99.00%	\$2,222,550

<sup>(1)</sup> JPMorgan Chase Bank, N.A., J.P. Morgan Securities LLC and their affiliates will act as placement agents for the Notes and will receive a fee from the Issuer of \$10 per \$1,000 in principal amount of the Notes.

The initial estimated value of the Notes as of the date of this pricing supplement is \$990.19 per \$1,000 in principal amount, which is less than the price to public. The actual value of the Notes at any time will reflect many factors, cannot be predicted with accuracy, and may be less than this amount. We describe our determination of the initial estimated value in more detail below.

RBC Capital Markets, LLC JPMorgan Chase Bank, N.A. J.P. Morgan Securities LLC  
 Placement Agents

Autocallable Contingent Coupon Barrier Notes with  
Memory Coupon Linked to the S&P 500® Index  
Royal Bank of Canada

SUMMARY

The information in this “Summary” section is qualified by the more detailed information set forth in this pricing supplement, the product prospectus supplement, the prospectus supplement, and the prospectus.

General:	This pricing supplement relates to an offering of Autocallable Contingent Coupon Barrier Notes (the “Notes”) linked to the S&P 500 Index (the “Reference Index”).
Issuer:	Royal Bank of Canada (“Royal Bank”)
Trade Date:	December 28, 2018
Issue Date:	January 3, 2019
Denominations:	Minimum denomination of \$1,000, and integral multiples of \$1,000 thereafter.
Designated Currency:	U.S. Dollars
Contingent Coupon and Memory Feature:	<p>We will pay you a Contingent Coupon during the term of the Notes, periodically in arrears on each Coupon Payment Date, under the conditions described below:</p> <ul style="list-style-type: none"> <li>· If the closing level of the Reference Index is greater than or equal to the Coupon Barrier on the applicable Observation Date (or in the case of the final Contingent Coupon due on the Maturity Date, the Final Level), we will pay the Contingent Coupon applicable to that Coupon Payment Date, together with any previously unpaid Contingent Coupons.</li> <li>· If the closing level of the Reference Index is less than the Coupon Barrier on the applicable Observation Date, we will not pay you the Contingent Coupon applicable to that Observation Date. You will not receive any Contingent Coupon on the Maturity Date if the Final Level is less than the Coupon Barrier.</li> </ul> <p>You may not receive a Contingent Coupon for one or more quarterly periods during the term of the Notes.</p> <p>For the avoidance of doubt, once a previously unpaid Contingent Coupon has been paid on a later Coupon Payment Date, it will not be paid again on a subsequent date.</p>
Contingent Coupon:	\$28.63 per \$1,000 in principal amount for each Coupon Payment Date that it is payable.
Observation Dates:	April 11, 2019, July 11, 2019 and October 10, 2019.
Coupon Payment Dates:	The Contingent Coupon, if applicable, will be paid on April 16, 2019, July 16, 2019, October 16, 2019 and the Maturity Date.
Record Dates:	The record date for each Coupon Payment Date will be one business day prior to that scheduled Coupon Payment Date; provided, however, that any Contingent Coupons payable at maturity or upon a call will be payable to the person to whom the payment at maturity or upon the call, as the case may be, will be payable.
Automatic Call Feature:	The Notes will be automatically called on any Coupon Payment Date (other than the final Coupon Payment Date) if the closing level of the Reference Index on the immediately preceding Observation Date is greater than or equal to the Initial Level.
Payment if Called:	If the Notes are called, then, on the applicable Coupon Payment Date, for each \$1,000 principal amount, you will receive \$1,000 plus the Contingent Coupon otherwise due on that Coupon Payment Date (together with any previously unpaid Contingent Coupons).
Valuation Dates:	January 6, 2020, January 7, 2020, January 8, 2020, January 9, 2020 and January 10, 2020

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Maturity Date:	January 15, 2020
Initial Level:	The closing level of the Reference Index on the Trade Date, as specified on the cover page of this pricing supplement.
Final Level:	The arithmetic average of the closing level of the Reference Index on each of the Valuation Dates.
Trigger Level	80% of the Initial Level, as specified on the cover page of this pricing supplement.
Coupon Barrier:	80% of the Initial Level, as specified on the cover page of this pricing supplement.

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Autocallable Contingent Coupon Barrier Notes with  
Memory Coupon Linked to the S&P 500® Index  
Royal Bank of Canada

If the Notes are not previously called, we will pay you at maturity an amount based on the Final Level:

Payment at  
Maturity (if not  
previously  
called and held  
to maturity):

- If the Final Level is greater than or equal to the Trigger Level, we will pay you a cash payment equal to the principal amount plus the Contingent Coupon otherwise due on the Maturity Date, together with any previously unpaid Contingent Coupons.

- If the Final Level is less than the Trigger Level, you will receive at maturity, for each \$1,000 in principal amount, a cash payment equal to:

$$\$1,000 + (\$1,000 \times \text{Underlying Return})$$

The amount of cash that you receive will be less than your principal amount, if anything, resulting in a loss that is proportionate to the decline from the Initial Level to the Final Level. Investors in the Notes could lose some or all of their investment if there has been a decline in the level of the Reference Index below the Trigger Level.

Underlying  
Return:

Final Level – Initial Level  
Initial Level

Market  
Disruption  
Events:

If a market disruption event occurs or is continuing on any scheduled Valuation Date other than the final Valuation Date, the closing level of the Reference Index for that Valuation Date will equal its closing level on the next scheduled Valuation Date. For example, if a market disruption event occurs or is continuing on the first and second scheduled Valuation Dates, but not on the third scheduled Valuation Date, then the closing level of the Reference Index will also be deemed to be its closing level on the first and second scheduled Valuation Dates. If no further scheduled Valuation Dates occur after a Valuation Date on which a market disruption event occurs or is continuing or if a market disruption event occurs or is continuing on the final Valuation Date, then the applicable closing level for that Valuation Date will be determined (or, if not determinable, estimated by the calculation agent in a manner which is considered to be commercially reasonable under the circumstances) by the calculation agent on that final Valuation Date, regardless of the occurrence or continuation of a market disruption event on that day. In such an event, the calculation agent will make a good faith estimate in its sole discretion of the closing level of the Reference Index that would have prevailed in the absence of the market disruption event.

Calculation  
Agent:

RBC Capital Markets, LLC (“RBCCM”)

U.S. Tax  
Treatment:

By purchasing a Note, each holder agrees (in the absence of a change in law, an administrative determination or a judicial ruling to the contrary) to treat the Notes as a callable pre-paid cash-settled contingent income-bearing derivative contract linked to the Reference Index for U.S. federal income tax purposes. However, the U.S. federal income tax consequences of your investment in the Notes are uncertain and the Internal Revenue Service could assert that the Notes should be taxed in a manner that is different from that described in the preceding sentence. Please see the section below, “Supplemental Discussion of U.S. Federal Income Tax Consequences,” and the discussion (including the opinion of our counsel Morrison & Foerster LLP) in the product prospectus supplement dated September 10, 2018 under “Supplemental

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Discussion of U.S. Federal Income Tax Consequences,” which apply to the Notes.

Secondary  
Market:

RBCCM (or one of its affiliates), though not obligated to do so, may maintain a secondary market in the Notes after the Issue Date. The amount that you may receive upon sale of your Notes prior to maturity may be less than the principal amount.

Listing:

The Notes will not be listed on any securities exchange.

Settlement:

DTC global (including through its indirect participants Euroclear and Clearstream, Luxembourg as described under “Description of Debt Securities—Ownership and Book-Entry Issuance” in the prospectus dated September 7, 2018).

Terms  
Incorporated in  
the Master  
Note:

All of the terms appearing above the item captioned “Secondary Market” on the cover page and pages P-2 and P-3 of this pricing supplement and the terms appearing under the caption “General Terms of the Notes” in the product prospectus supplement dated September 10, 2018, as modified by this pricing supplement.

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Autocallable Contingent Coupon Barrier Notes with  
Memory Coupon Linked to the S&P 500® Index  
Royal Bank of Canada

#### ADDITIONAL TERMS OF YOUR NOTES

You should read this pricing supplement together with the prospectus dated September 7, 2018, as supplemented by the prospectus supplement dated September 7, 2018 and the product prospectus supplement dated September 10, 2018, relating to our Senior Global Medium-Term Notes, Series H, of which these Notes are a part. Capitalized terms used but not defined in this pricing supplement will have the meanings given to them in the product prospectus supplement. In the event of any conflict, this pricing supplement will control. The Notes vary from the terms described in the product prospectus supplement in several important ways. You should read this pricing supplement carefully.

This pricing supplement, together with the documents listed below, contains the terms of the Notes and supersedes all prior or contemporaneous oral statements as well as any other written materials including preliminary or indicative pricing terms, correspondence, trade ideas, structures for implementation, sample structures, brochures or other educational materials of ours. You should carefully consider, among other things, the matters set forth in “Risk Factors” in the prospectus supplement dated September 7, 2018 and in the product prospectus supplement dated September 10, 2018, as the Notes involve risks not associated with conventional debt securities. We urge you to consult your investment, legal, tax, accounting and other advisors before you invest in the Notes. You may access these documents on the Securities and Exchange Commission (the “SEC”) website at [www.sec.gov](http://www.sec.gov) as follows (or if that address has changed, by reviewing our filings for the relevant date on the SEC website):

Prospectus dated September 7, 2018:

<https://www.sec.gov/Archives/edgar/data/1000275/000121465918005973/196181424b3.htm>

Prospectus Supplement dated September 7, 2018:

<https://www.sec.gov/Archives/edgar/data/1000275/000121465918005975/f97180424b3.htm>

Product Prospectus Supplement dated September 10, 2018:

<https://www.sec.gov/Archives/edgar/data/1000275/000114036118038089/form424b5.htm>

Our Central Index Key, or CIK, on the SEC website is 1000275. As used in this pricing supplement, “we,” “us,” or “our” refers to Royal Bank of Canada.

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Royal Bank of Canada

#### HYPOTHETICAL EXAMPLES

The table set out below is included for illustration purposes only. The table illustrates the Payment at Maturity of the Notes (excluding the final Contingent Coupon(s), if payable) for a hypothetical range of performance for the Reference Index, assuming the following terms and that the Notes are not called prior to maturity:

Hypothetical Initial Level:	100.00*
Hypothetical Trigger Level:	80, which is 80% of the hypothetical Initial Level
Hypothetical Coupon Barrier:	80, which is 80% of the hypothetical Initial Level
Contingent Coupon Amount:	\$28.63 for each Coupon Payment Date upon which it is payable
Principal Amount:	\$1,000 per Note

\* The hypothetical Initial Level of 100.00 used in the examples below has been chosen for illustrative purposes only and does not represent the actual Initial Level. The actual Initial Level is set forth on the cover page of this pricing supplement.

Hypothetical Final Levels are shown in the first column on the left. The second column shows the Payment at Maturity for a range of Final Levels. The third column shows the amount of cash to be paid on the Notes per \$1,000 in principal amount. If the Notes are called prior to maturity, the hypothetical examples below will not be relevant, and you will receive on the applicable Coupon Payment Date, for each \$1,000 principal amount, \$1,000 plus the Contingent Coupons otherwise due on the Notes (if payable).

Hypothetical Final Level	Payment at Maturity as Percentage of Principal Amount	Cash Payment Amount per \$1,000 in Principal Amount
130.00	100.00%	\$1,000.00*
120.00	100.00%	\$1,000.00*
110.00	100.00%	\$1,000.00*
100.00	100.00%	\$1,000.00*
90.00	100.00%	\$1,000.00*
80.00	100.00%	\$1,000.00*
79.90	79.99%	\$799.90
70.00	70.00%	\$700.00
60.00	60.00%	\$600.00
50.00	50.00%	\$500.00
40.00	40.00%	\$400.00
25.00	25.00%	\$250.00
0.00	0.00%	\$0.00

\*Excludes the final Contingent Coupon (and any previously unpaid Contingent Coupons), if payable.



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Hypothetical Examples of Amounts Payable at Maturity

The following hypothetical examples illustrate how the payments at maturity set forth in the table above are calculated, assuming the Notes have not been called.

Example 1: The level of the Reference Index increases by 25% from the Initial Level to the Final Level of 125.00. Because the Final Level is greater than the Trigger Level and Coupon Barrier, the investor receives at maturity, in addition to the final Contingent Coupon (and any previously unpaid Contingent Coupons) otherwise due on the Notes, a cash payment of \$1,000 per Note, despite the 25% appreciation in the level of the Reference Index.

Example 2: The level of the Reference Index decreases by 15% from the Initial Level to the Final Level of 85.00. Because the Final Level is greater than the Trigger Level and Coupon Barrier, the investor receives at maturity, in addition to the final Contingent Coupon (and any previously unpaid Contingent Coupons) otherwise due on the Notes, a cash payment of \$1,000 per Note, despite the 15% decline in the level of the Reference Index.

Example 3: The level of the Reference Index decreases by 50% from the Initial Level to the Final Level of 50.00, which is less than the Trigger Level. Because the Final Level is less than the Trigger Level and Coupon Barrier, the final Contingent Coupon will not be payable on the Maturity Date, and we will pay only \$500.00 for each \$1,000 in the principal amount of the Notes, calculated as follows:

$$\begin{aligned} & \text{Principal Amount} + (\text{Principal Amount} \times \text{Underlying Return}) \\ & = \$1,000 + (\$1,000 \times -50.00\%) = \$1,000 - \$500.00 = \$500.00 \end{aligned}$$

\* \* \*

The Payments at Maturity shown above are entirely hypothetical; they are based on levels of the Reference Index that may not be achieved on the Valuation Dates and on assumptions that may prove to be erroneous. The actual market value of your Notes on the Maturity Date or at any other time, including any time you may wish to sell your Notes, may bear little relation to the hypothetical Payments at Maturity shown above, and those amounts should not be viewed as an indication of the financial return on an investment in the Notes or on an investment in the securities included in the Reference Index.

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Autocallable Contingent Coupon Barrier Notes with  
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Royal Bank of Canada

**SELECTED RISK CONSIDERATIONS**

An investment in the Notes involves significant risks. Investing in the Notes is not equivalent to investing directly in the Reference Index. These risks are explained in more detail in the section “Risk Factors” in the product prospectus supplement. In addition to the risks described in the prospectus supplement and the product prospectus supplement, you should consider the following:

**Principal at Risk** — Investors in the Notes could lose all or a substantial portion of their principal amount if there is a decline in the level of the Reference Index between the Trade Date and the Valuation Dates. If the Notes are not called and the Final Level is less than the Trigger Level, the amount of cash that you receive at maturity will represent a loss of your principal that is proportionate to the decline in the closing level of the Reference Index from the Trade Date to the Valuation Dates. Any Contingent Coupons received on the Notes prior to the Maturity Date may not be sufficient to compensate for any such loss.

**The Notes Are Subject to an Automatic Call** — The Notes may be automatically called on any Coupon Payment Date other than the final Coupon Payment Date. If the Notes are so called, then, on the applicable Coupon Payment Date, for each \$1,000 in principal amount, you will receive \$1,000 plus the Contingent Coupon otherwise due on the applicable Coupon Payment Date (together with any previously unpaid Contingent Coupons). You will not receive any Contingent Coupons after that payment. You may be unable to reinvest your proceeds from the call in an investment with a return that is as high as the return on the Notes would have been if they had not been called.

**You May Not Receive Any Contingent Coupons** — We will not necessarily make any coupon payments on the Notes. If the closing level of the Reference Index on an Observation Date (or in the case of the final Contingent Coupon, the Final Level) is less than the Coupon Barrier, we will not pay you the applicable Contingent Coupon. If the closing level of the Reference Index is less than the Coupon Barrier on each of the Observation Dates, and if the Final Level is less than the Coupon Barrier, we will not pay you any Contingent Coupons during the term of, and you will not receive a positive return on your Notes. Generally, this non-payment of the Contingent Coupon coincides with a period of greater risk of principal loss on your Notes. Accordingly, if we do not pay the Contingent Coupon on the Maturity Date, you will also incur a loss of principal, because the Final Level will be less than the Trigger Level. Notwithstanding the memory feature described above, there can be no assurance that any unpaid Contingent Coupon will become payable during the term of the Notes.

**The Call Feature and the Contingent Coupon Feature Limit Your Potential Return** — The return potential of the Notes is limited to the pre-specified Contingent Coupon, regardless of the appreciation of the Reference Index. In addition, the total return on the Notes will vary based on the number of Observation Dates on which the Contingent Coupon becomes payable prior to maturity or an automatic call. Further, if the Notes are automatically called, you will not receive any Contingent Coupons or any other payment in respect of any Observation Dates after the applicable Coupon Payment Date. Since the Notes could be called as early as the first Coupon Payment Date, the total return on the Notes could be minimal. If the Notes are not called, you may be subject to the full downside performance of the Reference Index even though your potential return is limited to the Contingent Coupons that you may receive during the term of the Notes. As a result, the return on an investment in the Notes could be less than the return on a direct investment in securities included in the Reference Index.

**Your Return May Be Lower than the Return on a Conventional Debt Security of Comparable Maturity** — The return that you will receive on the Notes, which could be negative, may be less than the return you could earn on other investments. Even if your return is positive, your return may be less than the return you would earn if you bought a conventional senior interest bearing debt security of Royal Bank.

**Payments on the Notes Are Subject to Our Credit Risk, and Changes in Our Credit Ratings Are Expected to Affect the Market Value of the Notes** — The Notes are our senior unsecured debt securities. As a result, your receipt of any Contingent Coupons, if payable, and the amount due on any relevant payment date is dependent upon our ability to repay its obligations on the applicable payment dates. This will be the case even if the level of the Reference Index

increases after the Trade Date. No assurance can be given as to what our financial condition will be at any time during the term of the Notes.

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Autocallable Contingent Coupon Barrier Notes with  
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Royal Bank of Canada

**There May Not Be an Active Trading Market for the Notes-Sales in the Secondary Market May Result in Significant Losses** — There may be little or no secondary market for the Notes. The Notes will not be listed on any securities exchange. RBCCM and our other affiliates may make a market for the Notes; however, they are not required to do so. RBCCM or any other affiliate of ours may stop any market-making activities at any time. Even if a secondary market for the Notes develops, it may not provide significant liquidity or trade at prices advantageous to you. We expect that transaction costs in any secondary market would be high. As a result, the difference between bid and asked prices for your Notes in any secondary market could be substantial.

**Owning the Notes Is Not the Same as Owning the Securities Represented by the Reference Index** — The return on your Notes is unlikely to reflect the return you would realize if you actually owned the securities represented by the Reference Index. For instance, you will not receive or be entitled to receive any dividend payments or other distributions on those securities during the term of your Notes. As an owner of the Notes, you will not have voting rights or any other rights that holders of the Reference Index may have. Furthermore, the Reference Index may appreciate substantially during the term of the Notes, while your potential return will be limited to the applicable Contingent Coupon payments.

**The Initial Estimated Value of the Notes Is Less than the Price to the Public** — The initial estimated value set forth on the cover page of this pricing supplement does not represent a minimum price at which we, RBCCM or any of our affiliates would be willing to purchase the Notes in any secondary market (if any exists) at any time. If you attempt to sell the Notes prior to maturity, their market value may be lower than the price you paid for them and the initial estimated value. This is due to, among other things, changes in the levels of the Reference Index, the borrowing rate we pay to issue securities of this kind, and the inclusion in the price to the public of the underwriting discount and the estimated costs relating to our hedging of the Notes. These factors, together with various credit, market and economic factors over the term of the Notes, are expected to reduce the price at which you may be able to sell the Notes in any secondary market and will affect the value of the Notes in complex and unpredictable ways. Assuming no change in market conditions or any other relevant factors, the price, if any, at which you may be able to sell your Notes prior to maturity may be less than your original purchase price, as any such sale price would not be expected to include the underwriting discount and the hedging costs relating to the Notes. In addition to bid-ask spreads, the value of the Notes determined by RBCCM for any secondary market price is expected to be based on the secondary rate rather than the internal funding rate used to price the Notes and determine the initial estimated value. As a result, the secondary price will be less than if the internal funding rate was used. The Notes are not designed to be short-term trading instruments. Accordingly, you should be able and willing to hold your Notes to maturity.

**The Initial Estimated Value of the Notes on the Cover Page of this Pricing Supplement Is an Estimate Only, Calculated as of the Time the Terms of the Notes Were Set** — The initial estimated value of the Notes is based on the value of our obligation to make the payments on the Notes, together with the mid-market value of the derivative embedded in the terms of the Notes. See “Structuring the Notes” below. Our estimate is based on a variety of assumptions, including our credit spreads, expectations as to dividends, interest rates and volatility, and the expected term of the Notes. These assumptions are based on certain forecasts about future events, which may prove to be incorrect. Other entities may value the Notes or similar securities at a price that is significantly different than we do. The value of the Notes at any time after the Trade Date will vary based on many factors, including changes in market conditions, and cannot be predicted with accuracy. As a result, the actual value you would receive if you sold the Notes in any secondary market, if any, should be expected to differ materially from the initial estimated value of your Notes.

**We and Our Affiliates May Have Adverse Economic Interests to the Holders of the Notes** - We, RBCCM and our other respective affiliates trade the securities represented by the Reference Index, and other financial instruments related to the Reference Index, on a regular basis, for their accounts and for other accounts under our or their

management. We, RBCCM and our other affiliates may also issue or underwrite or assist unaffiliated entities in the issuance or underwriting of other securities or financial instruments that relate to the Reference Index. To the extent that we or any of our affiliates serves as issuer, agent or underwriter for such securities or financial instruments, our or their interests with respect to such products may be adverse to those of the holders of the Notes. Any of these trading activities could potentially affect the performance of the Reference Index and, accordingly, could affect the value of the Notes, and the amounts, if any, payable on the Notes.

We or our affiliates may currently or from time to time engage in business with the issuers of the securities represented by the Reference Index, including extending loans to, or making equity investments in, or providing advisory services to them, including merger and acquisition advisory services. In the course of this business, we or our affiliates may acquire

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Royal Bank of Canada

non-public information about these companies, and we will not disclose any such information to you. None of us or our affiliates makes any representation or warranty to any purchaser of the Notes with respect to any matters whatsoever relating to our business with the issuer of any security included in the Reference Index or future price movements of any such security.

Additionally, we or our affiliates may serve as issuer, agent or underwriter for additional issuances of securities with returns linked or related to changes in the level of the Reference Index. By introducing competing products into the marketplace in this manner, we could adversely affect the value of the Notes.

We may hedge our obligations under the Notes through certain affiliates, who would expect to make a profit on such hedge. We or our affiliates may adjust these hedges by, among other things, purchasing or selling those assets at any time, including around the time of the valuation dates, which could have an impact on the return of the Notes. Because hedging our obligations entails risk and may be influenced by market forces beyond our or our affiliates' control, such hedging may result in a profit that is more or less than expected, or it may result in a loss.

**Inconsistent Research** — Royal Bank or its affiliates may issue research reports on securities that are, or may become, components of the Reference Index. We may also publish research from time to time on financial markets and other matters that may influence the level of the Reference Index or the value of the Notes, or express opinions or provide recommendations that may be inconsistent with purchasing or holding the Notes or with the investment view implicit in the Notes or the Reference Index. You should make your own independent investigation of the merits of investing in the Notes and the Reference Index.

**Market Disruption Events and Adjustments** — The payment at maturity, each Observation Date and Valuation Dates are subject to adjustment as described in the product prospectus supplement. For a description of what constitutes a market disruption event as well as the consequences of that market disruption event, see “General Terms of the Notes—Market Disruption Events” in the product prospectus supplement.

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#### INFORMATION REGARDING THE REFERENCE INDEX

All disclosures contained in this pricing supplement regarding the Reference Index, including, without limitation, its make-up, method of calculation, and changes in their components, have been derived from publicly available sources. The information reflects the policies of, and is subject to change by, Standard & Poor's Financial Services LLC ("S&P"). The sponsor has no obligation to continue to publish, and may discontinue publication of, the Reference Index. The consequences of an index sponsor discontinuing publication of the Reference Index are discussed in the section of the product prospectus supplement entitled "General Terms of the Notes—Unavailability of the Level of a Reference Index." Neither we nor RBCCM accepts any responsibility for the calculation, maintenance or publication of the Reference Index or any successor index.

We obtained the information regarding the historical performance of the Reference Index set forth below from Bloomberg Financial Markets.

The Reference Index is intended to provide an indication of the pattern of common stock price movement. The calculation of the level of the Reference Index is based on the relative value of the aggregate market value of the common stocks of 500 companies as of a particular time compared to the aggregate average market value of the common stocks of 500 similar companies during the base period of the years 1941 through 1943.

S&P calculates the Reference Index by reference to the prices of the constituent stocks of the Reference Index without taking account of the value of dividends paid on those stocks. As a result, the return on the Notes will not reflect the return you would realize if you actually owned the Reference Index constituent stocks and received the dividends paid on those stocks.

Effective with the September 2015 rebalance, consolidated share class lines will no longer be included in the Reference Index. Each share class line will be subject to public float and liquidity criteria individually, but the company's total market capitalization will be used to evaluate each share class line. This may result in one listed share class line of a company being included in the Reference Index while a second listed share class line of the same company is excluded.

#### Computation of the Reference Index

While S&P currently employs the following methodology to calculate the Reference Index, no assurance can be given that S&P will not modify or change this methodology in a manner that may affect the payments on the Notes.

Historically, the market value of any component stock of the Reference Index was calculated as the product of the market price per share and the number of then outstanding shares of such component stock. In March 2005, S&P began shifting the Reference Index halfway from a market capitalization weighted formula to a float-adjusted formula, before moving the Reference Index to full float adjustment on September 16, 2005. S&P's criteria for selecting stocks for the Reference Index did not change with the shift to float adjustment. However, the adjustment affects each company's weight in the Reference Index.

Under float adjustment, the share counts used in calculating the Reference Index reflect only those shares that are available to investors, not all of a company's outstanding shares. Float adjustment excludes shares that are closely held by control groups, other publicly traded companies or government agencies.

In September 2012, all shareholdings representing more than 5% of a stock's outstanding shares, other than holdings by "block owners," were removed from the float for purposes of calculating the Reference Index. Generally, these "control holders" will include officers and directors, private equity, venture capital and special equity firms, other

publicly traded companies that hold shares for control, strategic partners, holders of restricted shares, ESOPs, employee and family trusts, foundations associated with the company, holders of unlisted share classes of stock, government entities at all levels (other than government retirement/pension funds) and any individual person who controls a 5% or greater stake in a company as reported in regulatory filings. However, holdings by block owners, such as depository banks, pension funds, mutual funds and ETF providers, 401(k) plans of the company, government retirement/pension funds, investment funds of insurance companies, asset managers and investment funds, independent foundations and savings and investment plans, will ordinarily be considered part of the float.

Treasury stock, stock options, equity participation units, warrants, preferred stock, convertible stock, and rights are not part of the float. Shares held in a trust to allow investors in countries outside the country of domicile, such as depository shares and Canadian exchangeable shares are normally part of the float unless those shares form a control block.

For each stock, an investable weight factor (“IWF”) is calculated by dividing the available float shares by the total shares outstanding. Available float shares are defined as the total shares outstanding less shares held by control holders. This calculation is subject to a 5% minimum threshold for control blocks. For example, if a company’s officers and directors hold 3% of the company’s shares, and no other control group holds 5% of the company’s shares, S&P would assign that company an IWF of

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1.00, as no control group meets the 5% threshold. However, if a company's officers and directors hold 3% of the company's shares and another control group holds 20% of the company's shares, S&P would assign an IWF of 0.77, reflecting the fact that 23% of the company's outstanding shares are considered to be held for control. As of July 31, 2017, companies with multiple share class lines are no longer eligible for inclusion in the Reference Index. Constituents of the Reference Index prior to July 31, 2017 with multiple share class lines will be grandfathered in and continue to be included in the Reference Index. If a constituent company of the Reference Index reorganizes into a multiple share class line structure, that company will remain in the Reference Index at the discretion of the S&P Index Committee in order to minimize turnover.

The Reference Index is calculated using a base-weighted aggregate methodology. The level of the Reference Index reflects the total market value of all 500 component stocks relative to the base period of the years 1941 through 1943. An indexed number is used to represent the results of this calculation in order to make the level easier to use and track over time. The actual total market value of the component stocks during the base period of the years 1941 through 1943 has been set to an indexed level of 10. This is often indicated by the notation 1941-43 = 10. In practice, the daily calculation of the Reference Index is computed by dividing the total market value of the component stocks by the "index divisor." By itself, the index divisor is an arbitrary number. However, in the context of the calculation of the Reference Index, it serves as a link to the original base period level of the Reference Index. The index divisor keeps the Reference Index comparable over time and is the manipulation point for all adjustments to the Reference Index, which is index maintenance.

#### Index Maintenance

Index maintenance includes monitoring and completing the adjustments for company additions and deletions, share changes, stock splits, stock dividends, and stock price adjustments due to company restructuring or spinoffs. Some corporate actions, such as stock splits and stock dividends, require changes in the common shares outstanding and the stock prices of the companies in the Reference Index, and do not require index divisor adjustments.

To prevent the level of the Reference Index from changing due to corporate actions, corporate actions which affect the total market value of the Reference Index require an index divisor adjustment. By adjusting the index divisor for the change in market value, the level of the Reference Index remains constant and does not reflect the corporate actions of individual companies in the Reference Index. Index divisor adjustments are made after the close of trading and after the calculation of the Reference Index closing level.

Changes in a company's total shares outstanding of 5% or more due to public offerings are made as soon as reasonably possible. Other changes of 5% or more (for example, due to tender offers, Dutch auctions, voluntary exchange offers, company stock repurchases, private placements, acquisitions of private companies or non-index companies that do not trade on a major exchange, redemptions, exercise of options, warrants, conversion of preferred stock, notes, debt, equity participations, at-the-market stock offerings or other recapitalizations) are made weekly, and are generally announced on Fridays for implementation after the close of trading the following Friday (one week later). If a 5% or more share change causes a company's IWF to change by five percentage points or more, the IWF is updated at the same time as the share change. IWF changes resulting from partial tender offers are considered on a case-by-case basis.

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#### License Agreement

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S&P DOW JONES INDICES DO NOT GUARANTEE THE ADEQUACY, ACCURACY, TIMELINESS AND/OR THE COMPLETENESS OF THE REFERENCE INDEX OR ANY DATA RELATED THERETO OR ANY COMMUNICATION, INCLUDING BUT NOT LIMITED TO, ORAL OR WRITTEN COMMUNICATION (INCLUDING ELECTRONIC COMMUNICATIONS) WITH RESPECT THERETO. S&P DOW JONES INDICES SHALL NOT BE SUBJECT TO ANY DAMAGES OR LIABILITY FOR ANY ERRORS, OMISSIONS, OR DELAYS THEREIN. S&P DOW JONES INDICES MAKE NO EXPRESS OR IMPLIED WARRANTIES, AND EXPRESSLY DISCLAIMS ALL WARRANTIES, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE OR AS TO RESULTS TO BE OBTAINED BY US, HOLDERS OF THE NOTES, OR ANY OTHER PERSON OR ENTITY FROM THE USE OF THE REFERENCE INDEX OR WITH RESPECT TO ANY DATA RELATED THERETO. WITHOUT LIMITING ANY OF THE FOREGOING, IN NO EVENT WHATSOEVER SHALL S&P DOW JONES INDICES BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES INCLUDING BUT NOT LIMITED TO, LOSS OF PROFITS, TRADING LOSSES, LOST TIME OR GOODWILL, EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, WHETHER IN CONTRACT, TORT, STRICT LIABILITY, OR OTHERWISE. THERE ARE NO THIRD PARTY BENEFICIARIES OF ANY AGREEMENTS OR

ARRANGEMENTS BETWEEN S&P DOW JONES INDICES AND US, OTHER THAN THE LICENSORS OF S&P DOW JONES INDICES.

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Historical Information

The graph below illustrates the performance of the Reference Index from January 1, 2008 to December 28, 2018. The information set forth below was obtained from Bloomberg Financial Markets, without any independent investigation. The red line represents the Trigger Level and Coupon Barrier of 1,988.59, which is equal to 80% of 2,485.74, which was its closing level on December 28, 2018 (rounded to two decimal places).

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#### SUPPLEMENTAL DISCUSSION OF U.S. FEDERAL INCOME TAX CONSEQUENCES

The following disclosure supplements, and to the extent inconsistent supersedes, the discussion in the product prospectus supplement dated September 10, 2018 under “Supplemental Discussion of U.S. Federal Income Tax Consequences.”

Under Section 871(m) of the Code, a “dividend equivalent” payment is treated as a dividend from sources within the United States. Such payments generally would be subject to a 30% U.S. withholding tax if paid to a non-U.S. holder. Under U.S. Treasury Department regulations, payments (including deemed payments) with respect to equity-linked instruments (“ELIs”) that are “specified ELIs” may be treated as dividend equivalents if such specified ELIs reference an interest in an “underlying security,” which is generally any interest in an entity taxable as a corporation for U.S. federal income tax purposes if a payment with respect to such interest could give rise to a U.S. source dividend. However, the IRS has issued guidance that states that the U.S. Treasury Department and the IRS intend to amend the effective dates of the U.S. Treasury Department regulations to provide that withholding on dividend equivalent payments will not apply to specified ELIs that are not delta-one instruments and that are issued before January 1, 2021. Based on our determination that the Notes are not delta-one instruments, non-U.S. holders should not be subject to withholding on dividend equivalent payments, if any, under the Notes. However, it is possible that the Notes could be treated as deemed reissued for U.S. federal income tax purposes upon the occurrence of certain events affecting the Reference Index or the Notes (for example, upon the Reference Index rebalancing), and following such occurrence the Notes could be treated as subject to withholding on dividend equivalent payments. Non-U.S. holders that enter, or have entered, into other transactions in respect of the Reference Index or the Notes should consult their tax advisors as to the application of the dividend equivalent withholding tax in the context of the Notes and their other transactions. If any payments are treated as dividend equivalents subject to withholding, we (or the applicable withholding agent) would be entitled to withhold taxes without being required to pay any additional amounts with respect to amounts so withheld.

The accompanying product prospectus supplement notes that FACTA withholding on payments of gross proceeds from a sale or Redemption of Notes will only apply to payments made after December 31, 2018. That discussion is modified to reflect regulations proposed by the U.S. Treasury Department indicating an intent to eliminate the requirement under FACTA of withholding on gross proceeds of the disposition of financial instruments. The U.S. Treasury Department has indicated that taxpayers may rely on these proposed regulations pending their finalization. Prospective investors are urged to consult with their own tax advisors regarding the possible implications of FACTA on their investment in the Notes.

#### SUPPLEMENTAL PLAN OF DISTRIBUTION (CONFLICTS OF INTEREST)

JPMorgan Chase Bank, N.A., J.P. Morgan Securities LLC and its affiliates will act as placement agents for the Notes and will receive a fee from the Issuer of \$10.00 per \$1,000 in principal amount of the Notes.

In addition, RBCCM or another of its affiliates or agents may use this document in market-making transactions after the initial sale of the Notes, but is under no obligation to do so and may discontinue any market-making activities at any time without notice.

We expect that delivery of the Notes will be made against payment for the Notes on January 3, 2019, which is the third (3rd) business day following the Trade Date (this settlement cycle being referred to as “T+3”). See “Plan of Distribution” in the prospectus dated September 7, 2018. For additional information as to the relationship between us and RBCCM, please see the section “Plan of Distribution—Conflicts of Interest” in the prospectus.

We will deliver the Notes on a date that is greater than two business days following the Trade Date. Under Rule 15c6-1 under the Exchange Act, trades in the secondary market generally are required to settle in two business days, unless the parties to any such trade expressly agree otherwise. Accordingly, purchasers who wish to trade the Notes more than two business days prior to the original issue date will be required to specify alternative settlement

arrangements to prevent a failed settlement.

The value of the Notes shown on your account statement may be based on RBCCM's estimate of the value of the Notes if RBCCM or another of our affiliates were to make a market in the Notes (which it is not obligated to do). That estimate will be based upon the price that RBCCM may pay for the Notes in light of then prevailing market conditions, our creditworthiness and transaction costs. For a period of approximately six months after the issue date of the Notes, the value of the Notes that may be shown on your account statement may be higher than RBCCM's estimated value of the Notes at that time. This is because the estimated value of the Notes will not include the underwriting discount and our hedging costs and profits; however, the value of the Notes shown on your account statement during that period may be a higher amount, reflecting the addition of RBCCM's underwriting discount and our estimated costs and profits from hedging the Notes. This excess is expected to decrease over time until the end of this period. After this period, if RBCCM repurchases your Notes, it expects to do so at prices that reflect their estimated value.

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## STRUCTURING THE NOTES

The Notes are our debt securities, the return on which is linked to the performance of the Reference Index. As is the case for all of our debt securities, including our structured notes, the economic terms of the Notes reflect our actual or perceived creditworthiness at the time of pricing. In addition, because structured notes result in increased operational, funding and liability management costs to us, we typically borrow the funds under these Notes at a rate that is more favorable to us than the rate that we might pay for a conventional fixed or floating rate debt security of comparable maturity. Using this relatively lower implied borrowing rate rather than the secondary market rate, is a factor that reduced the initial estimated value of the Notes at the time their terms were set. Unlike the estimated value included in this pricing supplement, any value of the Notes determined for purposes of a secondary market transaction may be based on a different funding rate, which may result in a lower value for the Notes than if our initial internal funding rate were used.

In order to satisfy our payment obligations under the Notes, we may choose to enter into certain hedging arrangements (which may include call options, put options or other derivatives) on the issue date with RBCCM or one of our other subsidiaries. The terms of these hedging arrangements take into account a number of factors, including our creditworthiness, interest rate movements, the volatility of the Reference Index, and the tenor of the Notes. The economic terms of the Notes and their initial estimated value depend in part on the terms of these hedging arrangements.

The lower implied borrowing rate is a factor that reduced the economic terms of the Notes to you. The initial offering price of the Notes also reflects the underwriting commission and our estimated hedging costs. These factors resulted in the initial estimated value for the Notes on the Trade Date being less than their public offering price. See “Selected Risk Considerations—The Initial Estimated Value of the Notes Is Less than the Price to the Public” above.

## VALIDITY OF THE NOTES

In the opinion of Norton Rose Fulbright Canada LLP, the issue and sale of the Notes has been duly authorized by all necessary corporate action of the Bank in conformity with the Indenture, and when the Notes have been duly executed, authenticated and issued in accordance with the Indenture and delivered against payment therefor, the Notes will be validly issued and, to the extent validity of the Notes is a matter governed by the laws of the Province of Ontario or Québec, or the laws of Canada applicable therein, and will be valid obligations of the Bank, subject to equitable remedies which may only be granted at the discretion of a court of competent authority, subject to applicable bankruptcy, to rights to indemnity and contribution under the Notes or the Indenture which may be limited by applicable law; to insolvency and other laws of general application affecting creditors’ rights, to limitations under applicable limitations statutes, and to limitations as to the currency in which judgments in Canada may be rendered, as prescribed by the Currency Act (Canada). This opinion is given as of the date hereof and is limited to the laws of the Provinces of Ontario and Québec and the federal laws of Canada applicable thereto. In addition, this opinion is subject to customary assumptions about the Trustee’s authorization, execution and delivery of the Indenture and the genuineness of signatures and certain factual matters, all as stated in the letter of such counsel dated September 7, 2018, which has been filed as Exhibit 5.1 to Royal Bank’s Form 6-K filed with the SEC dated September 7, 2018.

In the opinion of Morrison & Foerster LLP, when the Notes have been duly completed in accordance with the Indenture and issued and sold as contemplated by the prospectus supplement and the prospectus, the Notes will be valid, binding and enforceable obligations of Royal Bank, entitled to the benefits of the Indenture, subject to applicable bankruptcy, insolvency and similar laws affecting creditors’ rights generally, concepts of reasonableness and equitable principles of general applicability (including, without limitation, concepts of good faith, fair dealing and the lack of bad faith). This opinion is given as of the date hereof and is limited to the laws of the State of New York. This opinion is subject to customary assumptions about the Trustee’s authorization, execution and delivery of the Indenture and the genuineness of signatures and to such counsel’s reliance on the Bank and other sources as to certain

factual matters, all as stated in the legal opinion dated September 7, 2018, which has been filed as Exhibit 5.2 to the Bank's Form 6-K dated September 7, 2018.

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