

RVPortfolio Risk and P&L



RISKVAL
FINANCIAL SOLUTIONS

| Choice for Success

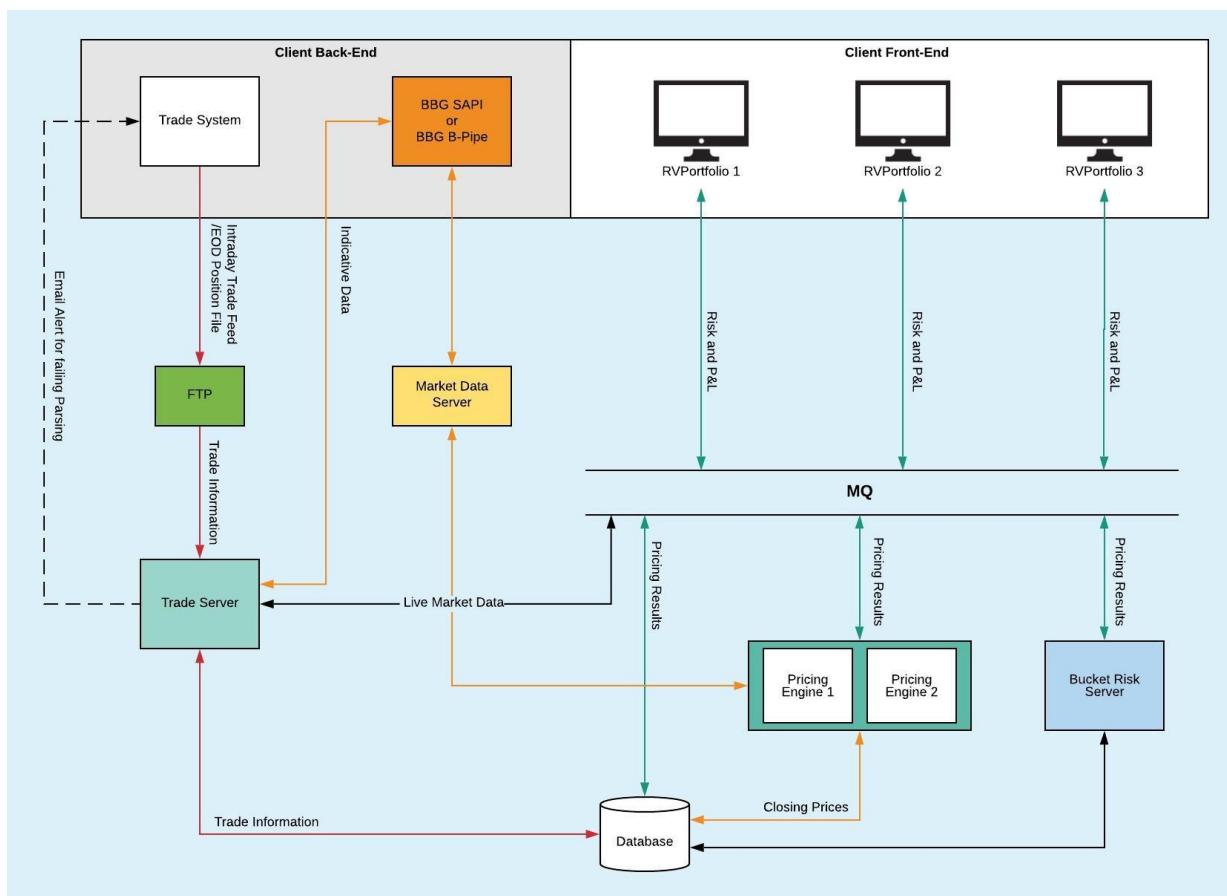
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OVERVIEW

RiskVal's RVPortfolio is a front and middle office platform that combines real-time P&L and Risk with the ability to forecast and manage risk well into the future. By using risk analysis tools, including but not limited to risk factor sensitivities, P&L Explanation, Historical Analysis, Scenario Analysis, and Value-at-Risk, RVPortfolio allows portfolio and risk managers to break down P&L and Risk from portfolio to trade level.

Our platform eliminates the tedious work required to identify risk factors and gives managers an intuitive tool that helps them make better decisions. RVPortfolio is built on RiskVal's pre-trade analytics* engine trusted by more than 100+ top-tier buy and sell-side firms. It assists traders and portfolio managers to interpret results in an actionable way, allowing them to minimize risk and maximize returns within a single platform.



[*Click to view RiskVal pre-trade analytics brochure](#)

BENEFITS

Expertise

Stress Tested - Tested and vetted by top buy and sell side traders and portfolio managers through various fixed income market cycles over the last 19 years

Risk Committee - A risk committee that brings expertise from across the industry to identify and address emerging issues in risk management

Award Winning - Numerous prestigious industry awards won, including Waters Technology and RiskTech 100

Analytics

Multiple Risk Measures - RVPortfolio risk metrics includes present value, hedge ratio, Value-at-Risk, P&L explanation, P&L scenarios, DV01 bucket risk, counterparty exposure and more

Customizable View - Users can aggregate risk from the most granular trade level up to the portfolio level

Highly Interactive - Ability to define liabilities as projected benefit obligations, accumulated benefit obligations or economic liabilities

Comprehensive Analysis - Bucket risk and non-parallel yield curve shifts empower users match assets to plan liabilities more effectively

Integration

SaaS - A software-as-a-service that can be deployed on site for maximum security or hosted to reduce the cost of hardware and maintenance

Seamless Connections - Position details updated daily using custodian or prime broker feeds

Real-time Market Data - Integrated pricing feeds or handlers that support numerous third-party vendors

Support

24/5 Support - Dedicated support team

Easy Access - Global support requests raised through Bloomberg chat, phone or email

Continuously Evolving - Frequent updates ensure cutting edge features and quick bug resolutions

BUCKET RISK

RVPortfolio's Bucket Risk enables enterprise-wide real-time spot and forward bucket risk analysis, as well as real-time P&L for each bucket. The spot bucket risk bumps the swap curve for P&L prediction and explanation. The forward bucket risk uses a combination of Euro Dollar strips and forward swap buckets. These tools provide insight into the curve sensitivities of the portfolio.

Methodology:

Bucket Risk measures present-value sensitivity to interest rates. The buckets correspond to the fitting points for the Libor curve build. To calculate the DV01 partials in RVPortfolio, RiskVal bootstraps the user-specified yield curve. Each point on the curve is shocked by -1 basis point. RiskVal then rebuilds the curve to reprice the portfolio and the resultant difference between the original and repriced PV is the rate exposure and risk for that bucket.

	Total	Treasury	TIPS	BondFut	BondFutOpt	Euro\$	Swaps	OISwap	Swaption	Spread Risk
Total	(28,075)	107,016	101,146	(362,622)	(16,517)	42,525	47,377	90,186	(37,189)	142,902
Total ex-stub	(13,188)	111,802	101,138	(368,253)	(17,148)	42,525	46,737	107,902	(37,920)	159,273
Stub	(14,887)	(4,786)	7	5,631	632	0	640	(17,715)	731	(16,371)
21-Jun	(18,187)	(4,940)	26	3,626	96	5,575	(6,700)	(15,066)	(777)	(16,996)
21-Sep	(19,887)	(4,913)	(14)	506	3	5,575	(6,106)	(14,588)	(321)	(15,467)
21-Dec	(25,583)	(6,881)	2	(7)	(1)	7,625	(11,968)	(14,451)	32	(18,695)
22-Mar	(31,554)	(7,513)	(35)	(30)	(6)	8,050	(17,206)	(14,704)	9	(23,971)
22-Jun	(30,545)	(7,488)	78	(31)	(3)	8,625	(17,056)	(14,693)	24	(23,101)
22-Sep	(33,192)	(6,958)	(13)	26	5	7,075	(17,828)	(15,489)	42	(26,252)
2 year	(174,421)	30	(20)	42	4	25,000	(108,774)	(83,841)	(7,055)	(174,477)
3 year	(134,434)	(144)	(122)	(332)	(30)	(25,000)	(126,512)	(431)	18,177	(133,805)
4 year	47,519	235	83	40,060	39	0	(890)	(587)	8,289	7,102
5 year	(66,772)	287	3	12,329	27	0	(10,850)	(786)	(67,531)	(79,418)
6 year	(23,311)	(25,316)	1	18,438	(1,442)	0	(12,444)	6,029	(8,578)	(14,993)
7 year	(28,933)	(55,462)	0	(91,370)	(15,842)	0	76,418	76,170	(18,847)	133,741
8 year	(19,896)	(1)	2	(14,942)	0	0	(3,464)	(1,353)	(138)	(4,955)
9 year	73,072	(13,716)	15,839	(471)	0	0	36,744	35,503	(827)	71,420
10 year	550,729	(187,399)	85,308	778	0	0	311,113	251,477	89,451	652,042
12 year	56,839	405	0	(334)	0	0	49,286	449	7,032	56,767
15 year	(53,360)	13	0	(31)	0	0	953	913	(55,208)	(53,342)
20 year	1,440	16	0	(49)	0	0	1,592	1,574	(1,693)	1,473
25 year	(773)	264,405	0	(265,165)	0	0	96	(110)	0	(13)
30 year	(81,939)	167,144	0	(71,296)	0	0	(89,670)	(88,117)	0	(177,786)

BASIS RISK

RVPortfolio's Basis Risk enables the portfolio manager to see the risk distribution among different basis spreads.

Methodology:

Basis Risk measures present-value sensitivity to basis spreads. The buckets correspond to the fitting points from basis curve building. To calculate the partials in RVPortfolio, RiskVal bootstrap the user-specified yield curve. Each point on the curve is shocked by -1 basis point. RiskVal then rebuilds the curve to re-price the portfolio and the resultant difference between the original and repriced PV is the rate exposure and risk for that bucket.

GBP		EUR		USD			
USD		1M vs 3M		USD		3M vs 6M	
1	Total	(20,218)		1	Total	48,743	
2	3M	0		2	6M	0	
3	6M	(0)		3	1Y	(1)	
4	9M	0		4	2Y	(2)	
5	1Y	0		5	3Y	(2)	
6	2Y	(20,219)		6	4Y	8	
7	3Y	0		7	5Y	48,741	
8	4Y	0		8	6Y	0	
9	5Y	0		9	7Y	0	
10	6Y	0		10	8Y	0	
11	7Y	0		11	9Y	0	
12	8Y	0		12	10Y	0	
13	9Y	0		13	12Y	0	
14	10Y	0		14	15Y	0	
15	12Y	0		15	20Y	0	
16	15Y	0		16	25Y	0	
17	20Y	0		17	30Y	0	
18	25Y	0		18	25Y	0	
19	30Y	0		19	30Y	0	

USD		1M vs 3M		USD		FF vs 3M		USD		3M vs 6M		USD		FF vs 3M	
1	Total	19,316		1	Total	41,163		1	Total	(91,914)		1	Total	(4,885)	
2	STUB	1,629		2	STUB	8		2	STUB	(4,989)		2	ED1	(4,952)	
3	ED1	2,519		3	ED1	8		3	ED1	(5,056)		3	ED2	(4,954)	
4	ED2	2,543		4	ED2	2,482		4	ED2	(4,952)		4	ED3	(4,952)	
5	ED3	2,519		5	ED3	2,500		5	ED3	(4,952)		5	ED4	(4,952)	
6	ED4	2,518		6	ED4	2,447		6	ED4	(4,952)		6	ED5	(4,947)	
7	ED5	2,475		7	ED5	2,418		7	ED5	(4,890)		7	ED6	(4,947)	
8	ED6	2,508		8	ED6	2,550		8	ED6	(4,888)		8	ED7	(4,888)	
9	ED7	2,508		9	ED7	2,457		9	ED7	(4,861)		9	ED8	(4,861)	
10	ED8	99		10	ED8	2,438		10	ED8	(4,791)		10	ED9	(4,791)	
11	ED9	0		11	ED9	2,408		11	ED9	(4,766)		11	ED10	(4,766)	
12	ED10	0		12	ED10	2,400		12	ED10	(4,700)		12	ED11	(4,700)	
13	ED12	0		13	ED12	2,414		13	ED12	(4,628)		13	ED13	(4,628)	
14	ED13	0		14	ED13	2,363		14	ED13	(4,606)		14	ED14	(4,606)	
15	ED14	0		15	ED14	2,388		15	ED14	(4,573)		15	ED15	(4,573)	
16	ED15	0		16	ED15	2,390		16	ED15	(4,573)		16	ED16	(4,573)	
17	ED16	0		17	ED16	2,484		17	ED16	(4,573)		17	ED17	(4,573)	
18	ED17	0		18	ED17	2,312		18	ED17	(4,573)		18	ED18	(4,573)	
19	ED18	0		19	ED18	2,335		19	ED18	(4,573)		19	ED19	(4,573)	
20	ED19	0		20	ED19	2,337		20	ED19	(4,573)		20	ED20	(4,573)	
21	ED20	0		21	ED20	24		21	ED20	(4,573)		21	ED21	(4,573)	
22	5YX1Y	0		22	5YX1Y	0		22	5YX1Y	(4,573)		22	6YX1Y	(4,573)	
23	6YX1Y	0		23	6YX1Y	0		23	6YX1Y	(4,573)		23	7YX1Y	(4,573)	
24	7YX1Y	0		24	7YX1Y	0		24	7YX1Y	(4,573)		24	8YX1Y	(4,573)	
25	8YX1Y	0		25	8YX1Y	0		25	8YX1Y	(4,573)		25	9YX1Y	(4,573)	
26	9YX1Y	0		26	9YX1Y	0		26	9YX1Y	(4,573)		26	10YX2Y	(4,573)	
27	10YX2Y	0		27	10YX2Y	0		27	10YX2Y	(4,573)		27	12YX3Y	(4,573)	
28	12YX3Y	0		28	12YX3Y	0		28	12YX3Y	(4,573)		28	15YX5Y	(4,573)	
29	15YX5Y	0		29	15YX5Y	0		29	15YX5Y	(4,573)		29	20YX5Y	(4,573)	
30	20YX5Y	0		30	20YX5Y	0		30	20YX5Y	(4,573)		30	30YX5Y	(4,573)	
31	30YX5Y	0		31	30YX5Y	0		31	30YX5Y	(4,573)		31	35YX5Y	(4,573)	
32	35YX5Y	0		32	35YX5Y	0		32	35YX5Y	(4,573)		32	40YX5Y	(4,573)	
33	40YX5Y	0		33	40YX5Y	0		33	40YX5Y	(4,573)		33	45YX5Y	(4,573)	
34	45YX5Y	0		34	45YX5Y	0		34	45YX5Y	(4,573)		34	50YX5Y	(4,573)	

STRIP RISK

RVPortfolio's Strip Risk enables portfolio managers to see the risk distribution among different forward buckets (FOMC, ED Futures and forward swaps).

Methodology:

Strip Risk measures present-value sensitivity to forward buckets. The buckets correspond to the fitting points from FOMC, ED Futures, and forward swaps. To calculate the strip partials in RVPortfolio, RiskVal bootstraps the user-specified yield curve that is shocked by -1 basis point and rebuilds the curve to reprice the portfolio. The difference between the original and repriced PV is used to capture the rate exposure per fitting point.

	Total	Treasury	TIPS	BondFut	BondFutOpt	Euro\$	Swap	OISwap	Swaption
Total	(40,422)	107,016	101,146	(362,622)	(16,517)	42,525	39,785	85,939	(37,694)
Total ex-stub	(4,602)	115,075	98,431	(364,237)	(16,517)	42,525	52,171	104,455	(36,505)
Stub	(35,820)	(8,059)	2,714	1,615	0	0	(12,385)	(18,516)	(1,189)
21-Jun	(39,431)	(8,251)	2,766	(473)	(545)	5,575	(19,886)	(15,884)	(2,734)
21-Sep	(41,519)	(8,289)	2,763	(3,642)	(649)	5,575	(19,618)	(15,406)	(2,252)
21-Dec	(46,844)	(10,185)	2,719	(4,068)	(638)	7,625	(25,202)	(15,260)	(1,834)
22-Mar	(52,999)	(10,848)	2,693	(4,090)	(647)	8,050	(30,651)	(15,635)	(1,871)
22-Jun	(52,332)	(10,859)	2,836	(4,131)	(651)	8,625	(30,642)	(15,634)	(1,877)
22-Sep	(56,328)	(10,539)	2,900	(4,284)	(681)	7,075	(32,342)	(16,482)	(1,975)
22-Dec	(21,175)	(3,071)	2,498	(3,697)	(588)	0	(13,115)	(1,424)	(1,777)
23-Mar	26,468	(3,364)	2,729	(4,008)	(642)	25,000	(1,533)	9,492	(1,207)
23-Jun	(23,025)	(3,538)	2,840	(4,209)	(675)	(25,000)	(1,643)	10,005	(804)
23-Sep	1,715	(3,318)	2,699	(3,910)	(631)	0	(1,505)	9,383	(1,003)
23-Dec	8,390	(3,311)	2,641	(3,894)	(629)	0	5,215	9,339	(970)
24-Mar	12,990	(3,311)	2,678	(3,857)	(627)	0	10,634	9,290	(1,817)
24-Jun	12,300	(3,303)	2,640	(3,840)	(625)	0	10,538	9,284	(2,395)
24-Sep	12,063	(3,304)	2,635	(3,803)	(623)	0	10,595	9,283	(2,720)
24-Dec	11,714	(3,216)	2,592	(3,654)	(606)	0	10,419	9,140	(2,962)
25-Mar	11,042	(3,380)	2,644	(4,526)	(635)	0	10,674	9,296	(3,032)
25-Jun	8,582	(3,292)	2,601	(6,776)	(618)	0	10,450	9,191	(2,974)
25-Sep	8,652	(3,294)	2,597	(6,742)	(616)	0	10,504	9,190	(2,987)
25-Dec	8,530	(3,218)	2,555	(6,580)	(602)	0	10,284	9,049	(2,959)
26-Mar	10,665	(3,358)	2,606	(6,831)	(625)	0	10,545	9,203	(876)
5Y x 1Y	51,016	(12,877)	10,011	(25,932)	(2,386)	0	43,649	35,768	2,784
6Y x 1Y	51,495	(6,198)	10,005	(27,863)	(1,581)	0	41,713	31,963	3,454
7Y x 1Y	56,368	(1,487)	9,736	(14,071)	0	0	33,186	23,827	5,175
8Y x 1Y	56,045	(1,577)	9,591	(13,796)	0	0	32,959	23,715	5,154
9Y x 1Y	35,457	4,472	5,456	(13,527)	0	0	22,077	13,043	3,936
10Y x 2Y	(6,295)	32,837	0	(26,219)	0	0	(620)	(5,643)	(6,649)
12Y x 3Y	(16,416)	47,319	0	(37,785)	0	0	(8,398)	(8,217)	(9,335)
15Y x 5Y	(11,410)	72,977	0	(58,280)	0	0	(13,188)	(12,919)	0
20Y x 5Y	(10,988)	66,537	0	(53,147)	0	0	(12,306)	(12,071)	0
25Y x 5Y	(9,332)	18,320	0	(6,602)	0	0	(10,620)	(10,431)	0
30Y x 5Y	0	0	0	0	0	0	0	0	0
35Y x 5Y	0	0	0	0	0	0	0	0	0
40Y x 5Y	0	0	0	0	0	0	0	0	0
45Y x 5Y	0	0	0	0	0	0	0	0	0

CREDIT RISK

RVPortfolio's Credit Risk enables portfolio managers to see the risk distribution among different credit default swap spread factors.

Methodology:

To capture the Credit Curve Exposure in RVPortfolio, RiskVal uses the user-specified credit spread to price the portfolio and calculate the PV. The credit spread is then shocked by one basis point and the PV on the new spread-adjusted curve is calculated. The difference between the original and repriced PV is the risk exposure of each product to its associated credit curve.

Description	CS01	CS01 6M	CS01 1Y	CS01 2Y
US53944YAA10 LLOYDS 4.5% 11/4/24	101	0	0	1
US20826FAG19 COP 3.35% 5/15/25	(4)	0	0	0
US00287YAX76 ABBV 2.85% 5/14/23	137	0	0	0
US00206RC594 T 3.6% 2/17/23	(7)	0	0	0
US24422ETL38 DE 2.65% 1/6/22	11	0	0	0
US4781608T00 JNJ 2.05% 3/1/23	8	0	0	0
US341099CP25 DUK 3.1% 8/15/21	(2)	0	0	0
US58013MEM29 MCD 2.625% 1/15/22	82	0	0	0
US037833AK68 AAPL 2.4% 5/3/23	(7,082)	(1)	(2)	(2)
US428236BV43 HPQ 4.65% 12/9/21	17	0	0	0
US110122AA65 BMY 7.15% 6/15/23	(46)	0	0	(1)
US654740AL38 NSANY 2.0% 3/8/19	6	0	2	4
US38141EC493 GS 2.04556% 12/15/17	(3)	(3)	0	0
EDH2 COMDTY	0	0	0	0
US00206RBM34 T 1.4% 12/1/17	2	2	0	0
US57772KAB70 MXIM 3.375% 3/15/23	12	0	0	0
US594918AW47 MSFT 3.625% 12/15/23	28	0	0	0
US717081DH33 PFE 3.0% 6/15/23	294	0	0	1
US883556BC51 TMO 3.15% 1/15/23	33	0	0	0
US68389XBL82 ORCL 2.4% 9/15/23	47	0	0	0
US4781608H61 JNJ 3.375% 12/5/23	14	0	0	0
US92343VBR42 VZ 5.15% 9/15/23	4,165	2	14	39
US38145GAJ94 GS 2.3% 12/13/19	(1)	0	0	(1)
US91324PCR10 UNH 4.75% 7/15/45	(1,950)	0	(2)	(4)
US36962G2T02 GE 5.55% 5/4/20	(28)	0	0	(4)
US05565QDC96 BPLN 1.676% 5/3/19	(11)	0	(1)	(9)
US38148LAA44 GS 2.6% 4/23/20	(1)	0	0	0
US38141EA661 GS 6.0% 6/15/20	(8)	0	0	0
US94974BGM63 WFC 2.6% 7/22/20	17	0	0	0
US94974BGA26 WFC 3.3% 9/9/24	176	0	0	1
US36164QM548 GE 2.342% 11/15/20	(6)	0	0	0
US577081AZ57 MAT 2.35% 5/6/19	(4)	0	(1)	(4)
US00507UAN19 AGN 2.30811% 3/12/18	(2)	(1)	(1)	0
US666807BE14 NOC 3.5% 3/15/21	(2)	0	0	0
US92343VDZ40 VZ 1.86472% 5/22/20	45	0	0	4
US38141EA588 GS 5.375% 3/15/20	(1)	0	0	0
US172967FF30 C 5.375% 8/9/20	8	0	0	0

VEGA RISK

RVPortfolio's Vega Risk further decomposes the conventional option Greek's Vega risk into an interest rate volatility grid (expiry x tenor). This gives portfolio managers a more precise and granular understanding of their volatility risk.

Methodology:

Vega Risk measures the present value sensitivity to ATM Normal Vol surface. For each cell in the Vol grid - for example, 1Y expiry and 5Y tenor - we calculate the present value of the selected portfolio (based on the books included) with market implied ATM Normal Vol surface. We then bump this surface by 1bp at the 1Yx5Y point only. The difference between the original and repriced PV is the present value sensitivity to the 1Yx5Y ATM Normal Vol.

	1Y	2Y	3Y	4Y	5Y	6Y	7Y	8Y	9Y	10Y	15Y	20Y	25Y	30Y	Total
Total	(5,875)	(8,834)	(4,186)	(1,878)	(1,002)	(1,289)	(1,322)	(4,584)	(5,888)	(8,824)	(14,423)	(20,175)	(2,888)	(32)	(81,201)
1M	291	(1,005)	1,000	773	419	5	56	(13)	(10)	(75)	(21)	0	(1)	(1)	1,418
3M	(54)	(792)	(450)	(145)	550	0	(1)	(42)	(14)	(181)	(42)	0	(1)	(2)	(1,174)
6M	(219)	(919)	(1,207)	(870)	(197)	(2)	(1)	(73)	(1)	(193)	(32)	(1)	(1)	(2)	(3,720)
1Y	(810)	(2,407)	(1,276)	(452)	(19)	(44)	(83)	(47)	(3)	(295)	(18)	(4)	(3)	(3)	(5,465)
2Y	(2,023)	(1,251)	(491)	(39)	(80)	(185)	(49)	(2)	(748)	(1,537)	(1,139)	(499)	(87)	(2)	(8,133)
3Y	(669)	(238)	(24)	(48)	(105)	(32)	(2)	(305)	(384)	(260)	(346)	(235)	(2)	0	(2,650)
4Y	(771)	(83)	(34)	(74)	(26)	(86)	(346)	(363)	(218)	(2,036)	(2,708)	(5,328)	(703)	0	(12,775)
5Y	(896)	(127)	(316)	(161)	(62)	(166)	(164)	(110)	(343)	(265)	(902)	(2,903)	(169)	(2)	(6,586)
7Y	(388)	(589)	(374)	(324)	(239)	(238)	(262)	(490)	(95)	(834)	(5,117)	(6,842)	(1,808)	(1)	(17,599)
10Y	(259)	(333)	(204)	(208)	(265)	(47)	(152)	(2,266)	(2,776)	(1,806)	(4,050)	(4,363)	(102)	0	(16,830)
15Y	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20Y	(77)	(1,091)	(810)	(328)	(979)	(494)	(317)	(872)	(1,296)	(1,344)	(48)	(1)	(11)	(19)	(7,688)

GAMMA RISK

RVPortfolio's Gamma Risk enables the portfolio managers to see the gamma bucket risk distribution for each scenario and product type, allowing them to see how the total interest rate risk behaves under different scenarios.

Methodology:

RiskVal calculates Portfolio level Gamma Risk to project the risk changes w.r.t large market moves. RVPortfolio calculates 10 gamma scenarios: -100, -50, -25, -10, -1, 0, 1, 10, 25, 50, 100 bps move.

	-100	-50	-25	-10	-1	0	1	10	25	50	100
Total	(4,533)	(4,118)	(1,128)	948	398	(0)	(362)	(6,377)	(33,046)	(114,716)	(177,325)
Stub	76	64	43	19	2	(0)	(2)	(20)	(46)	(81)	(127)
17-Sep	720	559	324	139	8	(0)	(27)	(228)	(587)	(1,055)	(1,656)
17-Dec	(242)	(334)	(252)	(104)	(6)	0	0	13	(131)	(478)	(1,002)
18-Mar	(307)	(352)	(259)	(117)	(4)	(0)	(2)	67	55	(166)	(627)
18-Jun	(249)	(270)	(197)	(93)	(11)	(0)	5	67	94	(10)	(346)
18-Sep	38	94	173	168	28	0	(37)	(528)	(2,400)	(7,753)	(12,166)
18-Dec	(182)	(158)	(110)	(54)	(8)	0	2	46	94	135	62
2 year	(1,460)	(1,279)	(595)	(7)	28	(0)	(60)	(1,193)	(6,793)	(23,157)	(36,208)
3 year	(3,156)	(2,759)	(1,452)	(324)	72	(0)	(34)	(825)	(5,839)	(22,324)	(33,741)
4 year	0	0	0	0	0	0	0	0	0	0	0
5 year	4,731	3,033	2,637	1,880	327	(0)	(291)	(4,244)	(18,226)	(60,562)	(95,511)
6 year	0	0	0	0	0	0	0	0	0	0	0
7 year	783	435	270	154	23	(0)	(8)	(303)	(1,262)	(3,312)	(4,234)
8 year	0	0	0	0	0	0	0	0	0	0	0
9 year	0	0	0	0	0	0	0	0	0	0	0
10 year	1,546	679	312	120	13	(0)	0	(108)	(252)	(507)	(960)
12 year	(1,348)	(746)	(402)	(168)	(16)	(0)	27	178	446	853	1,677
15 year	(1,715)	(894)	(450)	(182)	(13)	(0)	23	184	459	916	1,729
20 year	(1,808)	(1,025)	(536)	(221)	(20)	(0)	30	234	595	1,216	2,432
25 year	(1,338)	(816)	(447)	(189)	(19)	(0)	22	206	544	1,144	2,472
30 year	(383)	(243)	(134)	(56)	(5)	(0)	7	59	156	330	712
40 year	(128)	(58)	(28)	(11)	(1)	(0)	1	10	25	49	89
50 year	(110)	(50)	(24)	(9)	(1)	(0)	1	9	23	44	82

VAR: HISTORICAL SIMULATION

RVPortfolio's Value at Risk (VaR) estimates a threshold loss value for a given probability for a given time horizon (such as one day). VaR is typically used by firms and regulators to gauge the amount of assets needed to cover possible losses. It summarizes the market risk exposure of all financial instruments in a portfolio into a single number.

Historical simulation is one way of calculating VaR. RiskVal's Historical Simulation estimates the hypothetical time series of returns on a given portfolio by running the portfolio through actual historical data and computing the P&L change that would have occurred in each period.

Total	AUD	CAD	EUR	GBP	USD				
PnL Summary									
	Date	Factors PnL USD	Rate Risk PnL USD	OIS Risk PnL USD	Basis Risk PnL USD	Swap Spread Risk PnL USD	CMT Spread Risk PnL USD	Gross Basis Risk PnL USD	
1	07-Sep-2017	1,864,842	(2,018,782)	80,691	519,990	2,776,238	303,683	203,023	
2	06-Sep-2017	775,421	(300,069)	353,254	(310,536)	255,854	(758,187)	1,535,104	
3	05-Sep-2017	129,581	(656,897)	(184,606)	(321,285)	(538,973)	1,088,815	742,527	
4	04-Sep-2017	(784,815)	(801,849)	206,855	(145,220)	360,182	(756,760)	351,976	
5	01-Sep-2017	571,866	(991,922)	(29,599)	(5,743)	1,206,017	(439,946)	833,059	
6	31-Aug-2017	(359,511)	(924,914)	(370,594)	231,060	(76,798)	227,652	554,082	
7	30-Aug-2017	149,306	(540,695)	496,896	15,137	340,826	(476,353)	313,494	
8	29-Aug-2017	363,616	45,912	(259,452)	(128,657)	(265,827)	815,716	155,923	
9	28-Aug-2017	(545,303)	74,410	(41,262)	5,035	(163,780)	(913,188)	493,482	
10	25-Aug-2017	142,157	531,752	44,436	(672,408)	(1,108,365)	1,315,467	31,275	
11	24-Aug-2017	259,335	81,719	(33,872)	234,162	(244,101)	(117,397)	338,824	
12	23-Aug-2017	1,542,348	508,486	156,050	(201,372)	(100,899)	799,589	380,495	
13	22-Aug-2017	2,580,963	(576,136)	205,999	204,639	1,285,419	90,039	1,371,003	
14	21-Aug-2017	(456,948)	1,186,475	(100,336)	(229,932)	(820,921)	(783,877)	291,644	
15	18-Aug-2017	1,374,466	(2,411,512)	435,897	342,573	1,905,399	743,772	358,337	
16	17-Aug-2017	1,481,781	(227,635)	584,068	(33,032)	(799,249)	376,532	1,581,098	
17	16-Aug-2017	182,569	(788,371)	(194,849)	(549,507)	636,613	123,699	954,983	
18	15-Aug-2017	1,472,610	529,460	215,586	(30,241)	(686,816)	(37,136)	1,481,757	
19	14-Aug-2017	1,614,343	350,596	(124,399)	475,359	591,287	(805,655)	1,127,155	
20	11-Aug-2017	319,430	(532,307)	(43,734)	(271,097)	715,056	684,513	(233,001)	
21	10-Aug-2017	2,020,275	91,954	(157,805)	(463,987)	342,382	666,737	1,540,994	
22	09-Aug-2017	278,543	(1,636,107)	(67,001)	(114,377)	852,191	1,038,972	204,865	
23	08-Aug-2017	386,785	674,337	8,769	(62,794)	(1,208,376)	(52,753)	1,027,602	
24	07-Aug-2017	363,900	(286,878)	(80,387)	(444,509)	410,767	171,616	593,291	
25	04-Aug-2017	1,410,174	1,282,834	210,055	177,958	(21,983)	(915,552)	676,861	
26	03-Aug-2017	717,231	(1,211,447)	(84,810)	(202,367)	(832,864)	1,401,761	1,646,958	
27	02-Aug-2017	(73,989)	(21,599)	(442,426)	330,987	284,345	(93,157)	(132,139)	
28	01-Aug-2017	1,353,585	(1,439,315)	298,701	369,805	1,566,090	(916,963)	1,475,267	
29	31-Jul-2017	(2,830,568)	540,242	(324,118)	(233,682)	(1,021,744)	(634,488)	(1,156,778)	
30	28-Jul-2017	1,906,311	(123,069)	(344,686)	236,485	928,914	11,567	1,197,071	
31	27-Jul-2017	1,607,901	(1,096,712)	11,811	189,092	948,978	610,670	944,060	
32	26-Jul-2017	1,886,157	1,979,654	(9,833)	(580,778)	(1,842,245)	594,191	1,745,168	

As some financial instruments such as futures and newly issued treasuries have limited historical data, getting the data may prove challenging. RiskVal leverages its 20 years of proprietary historical data to calculate the historical market price for each financial instrument.

Runtime computation for sophisticated portfolios also takes a long time. RiskVal employs state of the art processing machines and servers to deliver the quickest performance and turnaround time.

To accommodate the needs of the middle office, we leverage our understanding of market risks and calculate the risk exposure to each market factor for each financial instrument. We then use the Taylor expansion (delta-gamma approach) to estimate the historical market price for each financial instrument. From this, we estimate the time series of returns over 20 years for each portfolio. From the distribution of returns, we estimate VaR.

Methodology:

Given an analysis date and look back period, the VaR report will calculate the Value at Risk (VaR) based on historical daily market data changes. We then add the series of daily market changes to current market data, reprice the portfolio to obtain a series of P&L. The VaR and Vol are then calculated based on this series.

Vol Statistics	Local Ccy	USD
90d Vol	1,359,775	1,359,775
1y Vol	1,175,426	1,175,426
Max	5,235,823	5,235,823
Min	(5,802,919)	(5,802,919)
Average	(123,387)	(123,387)
Median	(10,738)	(10,738)
21d Max Drawdown	(24,164,872)	(24,164,872)
Worst 10d rolling	(17,449,460)	(17,449,460)
%Up Days	48.18%	48.18%
%Down Days	51.82%	51.82%

Daily	Local Ccy	USD
95% VaR	(2,046,980)	(2,046,980)
99% VaR	(3,535,741)	(3,535,741)
95% CVaR	(3,063,181)	(3,063,181)

Weekly	Local Ccy	USD
Horizon	Local Ccy	USD
95% VaR	(4,577,186)	(4,577,186)
99% VaR	(7,906,157)	(7,906,157)
95% CVaR	(6,849,481)	(6,849,481)

SCENARIO ANALYSIS

RVPORtfolio's Scenario Analysis estimates the expected value of a portfolio given a point in time or a period of time, and assumes specific changes in the value of certain securities or key factors, such as a change in interest rates. Based on mathematical and statistical principals, scenario analysis provides a process to estimate shifts in the value of a portfolio, based on different scenarios, following the principals of a "what if" analysis.

RVPORtfolio allows managers to stress numerous underlying risk factors, including yield curves, swap spreads, volatility and more. The results of each scenario are easily compared to current mark-to-markets of the portfolio to see the impact of market movement on portfolio value.

RiskVal's Scenario Analysis includes, but is not limited to, one or any combination of the following scenarios:

- Interest Rate moves (for example, interest rate parallel rally 100bps; Bull/Flattener)
- Interest Rate Volatility moves (for example, ATM Vol increase 10%)
- Time changes (Horizontal Analysis)
- Swap Spread moves
- Credit Spread moves
- FX rate & volatility moves and more

PNL Scenario Analysis						
Hierarchy		>MS				
	Type	Rate	Swap Spread	Credit Spread	Curve	Vol Skew
1		+5bps	+5bps	+5bps	Bear steepener 2y +25bps, 30y +125bps	+10%
2	Bond	17,170,765	0	0	142,193,987	0
3	IR Swap	3,985,853	3,985,853	(0)	(11,210,453)	(0)
4	Generic Option	0	0	0	(13,443,754)	33,730
5	Future	(20,928,666)	119,892	0	(156,069,951)	0
6	IR Basis Swap	(1,256,197)	(1,256,197)	(0)	(112,780)	(0)
7	Cross Currency Swap	28,840	28,840	(0)	(70,141)	0
8	FRA	186,594	186,594	(0)	(315,409)	0
9	Swaption	0	0	0	0	0
10	Total	(812,811)	3,064,982	(0)	(39,028,501)	33,730

STRESS TEST - SCENARIO CASES

RiskVal predefines 4 scenarios - 9/11, Lehman Default 2008, Brexit 2018 Q4, and 2016 U.S. Election. Users can also define their own custom scenarios.

Scenario: 9/11

Historical Dates: 9/10/2001 to 9/21/2001

The 9/11 attacks were a series of four attacks that were committed in the United States on September 11, 2001.

911 Scenario Settings								
LIBOR/Swap								
Index	1Y	2Y	5Y	10Y	30Y	Shift Method	Scale	
USD	(74.50)	(8.50)	(59.00)	(44.30)	(23.70)	2.10	absolute	bp
EUR	(52.00)	(46.20)	(32.83)	(10.95)	2.92	14.82	absolute	bp
GBP	(34.55)	(41.00)	(21.50)	(6.00)	1.00	11.00	absolute	bp
JPY	0.81	1.00	0.85	1.05	(2.55)	0.00	absolute	bp
CAD	(61.67)	(65.00)	(51.50)	(27.50)	(2.50)	15.00	absolute	bp
DEFAULT	(74.50)	(8.50)	(59.00)	(44.30)	(23.70)	2.10	absolute	bp
Swap Spread								
1Y	2Y	5Y	10Y	30Y	Shift Method	Scale		
USD	(73.00)	6.50	5.00	(10.50)	(16.00)	absolute	bp	
EUR	3.20	12.05	5.80	(1.85)	(8.70)	absolute	bp	
GBP	(4.40)	4.60	9.00	(3.60)	(5.00)	absolute	bp	
JPY	1.00	(1.00)	1.00	(1.00)	2.60	absolute	bp	
CAD		6.00	2.50	0.00	(1.90)	absolute	bp	
DEFAULT	(73.00)	6.50	5.00	(10.50)	(16.00)	absolute	bp	
Swaption Vol								
Type	Change	Shift Method	Scale					
USD	normal	6.63	absolute					
EUR	normal	2.27	absolute					
GBP	lognormal	3.85	absolute					
JPY	normal	(1.96)	absolute					
CAD	lognormal	0.00	absolute					
DEFAULT	normal	6.63	absolute					
FX Rate								
Change	Shift Method	Scale						
EURUSD	1.88	relative						
GBPUKD	(0.01)	relative						
USDJPY	(3.68)	relative						
USDCAD	0.52	relative						
DEFAULT	1.88	relative						
Change	Shift Method	Scale						
EURUSD	13.28	relative						
GBPUKD	4.47	relative						
USDJPY	14.42	relative						
USDCAD	(1.27)	relative						
DEFAULT	13.28	relative						

Scenario: Lehman Default 2008

Historical Dates: 9/15/2008 to 10/14/2008

This scenario measures the impact of the largest bankruptcy filing in U.S. history, with Lehman holding over US\$600 Billion in assets.

Lehman Scenario Settings

LIBOR/Swap

	Index	1Y	2Y	5Y	10Y	30Y	Shift Method	Scale
USD	181.88	28.00	41.56	68.57	65.70	7.40	absolute	bp
EUR	11.10	(45.60)	(22.04)	(3.35)	3.60	(25.30)	absolute	bp
GBP	50.25	(56.00)	(28.20)	(9.12)	(4.80)	(27.50)	absolute	bp
JPY	19.88	8.57	10.25	15.70	(4.65)	(43.50)	absolute	bp
CAD	0.00	(27.80)	(7.13)	15.60	31.25	23.40	absolute	bp
DEFAULT	181.88	28.00	41.56	68.57	65.70	7.40	absolute	bp

Swap Spread

	1Y	2Y	5Y	10Y	30Y	Shift Method	Scale
USD	82.48	31.00	20.62	(4.13)	(18.50)	absolute	bp
EUR	101.07	22.21	1.79	(2.76)	(20.36)	absolute	bp
GBP	20.94	12.87	(31.17)	(33.50)	(55.63)	absolute	bp
JPY	(9.23)	0.25	9.30	(9.75)	(39.00)	absolute	bp
CAD		2.38	(6.38)	(13.75)	(13.50)	absolute	bp
DEFAULT	82.48	31.00	20.62	(4.13)	(18.50)	absolute	bp

Swaption Vol

	Type	Change	Shift Method	Scale
USD	normal	22.00	absolute	bp
EUR	normal	18.75	absolute	bp
GBP	lognormal	1.80	absolute	percent
JPY	normal	19.41	absolute	bp
CAD	lognormal	3.00	absolute	percent
DEFAULT	normal	22.00	absolute	bp

Inflation

	1Y	2Y	5Y	10Y	20Y	30Y	Shift Method	Scale
USD	(55.50)	(122.00)	(31.75)	(22.25)		(35.75)	absolute	bp
FRF	93.75	(15.55)	(5.95)	(8.20)		(18.65)	absolute	bp
ITL	(14.85)	(43.06)	(47.80)	(43.24)		(46.15)	absolute	bp
GBP	(123.50)	(103.60)	(72.70)	(27.00)	1.20	absolute	bp	
JPY	(50.00)	(65.00)	(85.00)	(98.00)	(70.00)	absolute	bp	
EUR	(28.85)	(46.05)	(24.05)	(15.25)	(24.40)	absolute	bp	
CAD	(119.40)	(94.31)	(51.04)	(32.29)	(40.70)	absolute	bp	
DEFAULT	(55.50)	(122.00)	(31.75)	(22.25)	(35.75)	absolute	bp	

FX Rate

	Change	Shift Method	Scale
EURUSD	(4.38)	relative	percent
GBPUSD	(3.34)	relative	percent
USDJPY	(2.47)	relative	percent
USDCAD	8.60	relative	percent
DEFAULT	(4.38)	relative	percent

	Change	Shift Method	Scale
EURUSD	21.16	relative	percent
GBPUSD	25.85	relative	percent
USDJPY	13.33	relative	percent
USDCAD	14.79	relative	percent
DEFAULT	21.16	relative	percent

Scenario: Brexit 2018 Q4

Brexit is the withdrawal of the United Kingdom (UK) from the European Union (EU). The referendum was held on 6/23/2016 to leave the EU. Then Brexit withdrawal agreement was published on 11/14/2018. On 11/25/2018, the other EU Member states endorsed the Withdrawal Agreement.

This scenario measures the 2018 Q4 market impact.

Brexit2018Q4 Scenario Settings												
	1Y	2Y	3Y	4Y	5Y	6Y	7Y	8Y	9Y	10Y	Shift Method	Scale
USD	(36.62)	(31.45)	(24.02)	(18.60)	(15.34)	(13.33)	(11.68)	(10.55)	(9.74)	(8.86)	absolute	bp
EUR	(33.00)	(41.88)	(36.90)	(31.05)	(26.53)	(23.07)	(20.26)	(18.15)	(16.60)	(15.41)	absolute	bp
GBP	(100.22)	(84.08)	(72.06)	(66.75)	(57.03)	(48.41)	(42.79)	(38.18)	(34.48)	(31.87)	absolute	bp
JPY	(6.44)	(8.79)	(8.79)	(8.17)	(7.76)	(6.52)	(5.93)	5.35	(4.72)	absolute	bp	
CAD	(10.88)	(10.88)	(9.37)	(8.28)	(7.51)	(6.59)	(5.86)	(5.27)	(4.76)	(4.32)	absolute	bp

Swaption Vol												
Type	Change	Shift Method	Scale									
USD	lognormal	13.44	relative	percent								
EUR	normal	26.55	relative	percent								
GBP	lognormal	82.98	relative	percent								

Inflation												
Shift Type	Change	Shift Method	Scale									
USD	parallel	(15.28)	absolute	bp								
FRF	parallel	(13.04)	absolute	bp								
ITL	parallel	(13.04)	absolute	bp								
GBP	parallel	(41.40)	absolute	bp								
ESP	parallel	(13.04)	absolute	bp								
EUR	parallel	(13.04)	absolute	bp								

FX Rate												
	Change	Shift Method	Scale									
GBPCAD	(7.98)	relative	percent									
GBPEUR	(10.00)	relative	percent									
GBJPY	(13.12)	relative	percent									
GBPUSD	(10.00)	relative	percent									

FX Vol															
	1W	2W	3W	1M	2M	3M	6M	1Y	18M	2Y	3Y	5Y	10Y	Shift Method	Scale
EURUSD	42.10	32.70	24.04	15.25	15.11	10.86	6.74	4.84	4.22	3.75	2.15	4.38	2.32	relative	percent
GBPUSD	57.88	38.15	33.59	27.43	29.34	21.83	16.15	13.23	10.57	9.21	4.58	5.35	3.65	relative	percent

Scenario: 2016 U.S. presidential election

The 2016 United States presidential election was held on 11/08/2016, in which the Republican ticket of businessman Donald Trump and Indiana Governor Mike Pence defeated the Democratic ticket of the former Secretary of State Hillary Clinton and U.S. Senator from Virginia Tim Kaine.

This scenario measures the 2016 Q4 market impact.

2016 Election Scenario Settings

LIBOR/Swap

	1Y	2Y	3Y	4Y	5Y	6Y	7Y	8Y	9Y	10Y	Scale
USD	(15.32)	(13.16)	(10.05)	(7.78)	(6.42)	(5.58)	(4.89)	(4.41)	(4.07)	(3.71)	bp
EUR	(10.35)	(13.13)	(11.57)	(9.74)	(8.32)	(7.23)	(6.35)	(5.69)	(5.21)	(4.83)	bp
GBP	(37.50)	(31.46)	(26.96)	(24.98)	(21.34)	(18.11)	(16.01)	(14.29)	(12.90)	(11.93)	bp
JPY	(2.70)	(3.68)	(3.58)	(3.58)	(3.42)	(3.25)	(2.73)	(2.48)	(2.24)	(1.98)	bp
CAD	(4.55)	(4.58)	(3.92)	(3.46)	(3.14)	(2.76)	(2.45)	(2.21)	(1.99)	(1.81)	bp

Swaption Vol

	Type	Change	Shift Method	Scale
USD	lognormal	5.62	relative	percent
EUR	normal	8.33	relative	percent
GBP	lognormal	31.05	relative	percent

Inflation

	Shift Type	Change	Shift Method	Scale
USD	parallel	(1.40)	absolute	bp
FRF	parallel	(2.08)	absolute	bp
ITL	parallel	(2.08)	absolute	bp
GBP	parallel	74.84	absolute	bp
ESP	parallel	(2.08)	absolute	bp
EUR	parallel	(2.08)	absolute	bp

FX Rate

	Change	Shift Method	Scale
GBPEUR	(10.00)	relative	percent
GBPUSD	(10.00)	relative	percent
GBPCAD	(8.01)	relative	percent
GBPJPY	(12.94)	relative	percent

FX Vol

	1W	2W	3W	1M	2M	3M	6M	1Y	18M	2Y	5Y	10Y	Shift Method	Scale
EURUSD	24.99	14.40	10.16	9.91	8.81	7.39	4.36	3.79	3.19	2.75	4.74	1.93	relative	percent
GBPUSD	39.35	25.20	23.83	24.64	21.28	18.11	13.50	11.30	8.95	8.06	6.18	3.74	relative	percent