Risk Premium and Optimum Asset Allocation

Richard Guay
Executive Vice-President
Risk Management and Depositors' Accounts Management

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- ## Risk premium estimate:
    - ### Historical excess yields
    - ### Prospective approaches:
        - Breakdown of returns
        - Implicit risk premium: EBO model

- ## Risk and return on assets and surplus:
    - ### Asset optimization
    - ### Surplus optimization

- ## Globalization and population aging

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Historical Real Returns

1900-2000 (Dimson, March and Staunton) – Percentages

Country	Geometric Return			Stnd. deviation Excess return	Inflation
	Stocks	**Bonds**	**Excess return**		
South Africa	6.9	1.4	5.7	19.7	4.8
Germany	4.4	-2.2	6.7	28.4	5.1*
Australia	7.5	1.1	6.3	18.9	4.1
Belgium	2.6	-0.4	3.1	20.7	5.5
Canada	**6.4**	**1.8**	**4.5**	**17.8**	**3.1**
Denmark	4.6	2.6	2.0	16.9	4.1
Spain	3.7	1.3	2.3	20.3	6.1
United States	6.7	1.6	5.0	20.0	3.2
France	3.9	-1.0	4.9	21.6	7.9
Ireland	4.8	1.4	3.2	17.4	4.5
Italy	2.7	-2.2	5.0	30.0	9.1
Japan	4.6	-1.6	6.2	33.2	7.6
Netherlands	5.8	1.1	4.7	21.4	3.0
United Kingdom	5.8	1.2	4.4	16.7	4.1
Sweden	7.6	2.4	5.2	22.1	3.7
Switzerland	5.3	2.8	2.7	17.9	2.2
World equiweighted			**4.5**		
World weighed			**4.6**	**14.5**	

* For Germany, years 1922-23 are excluded.

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Historical Real Returns
Time Horizon: 1802-2001 (Siegel, 2002, United States) – Percentages

Holding period	Stocks		Bonds		% Stocks > Bonds	Risk	
	Min.	Max.	Min.	Max.		Stocks	Bonds
1 year	-38.6	66.6	-21.9	35.1	61	18.1	8.6
2 years	-31.6	41.0	-15.9	24.7	65	13.0	6.4
5 years	-11.0	26.7	-10.1	17.7	71	7.5	5.2
10 years	-4.1	16.9	-5.4	12.4	80	4.3	4.0
20 years	1.0	12.6	-3.1	8.8	92	2.9	3.1
30 years	2.6	10.6	-2.0	7.4	99	1.5	2.6

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Historical Real Returns
1956-2002

	Canada		United States	
	S&P/TSX	**Bonds ***	**S&P 500**	**Bonds ****
1956-2002				
Geometric return	4.5	3.6	5.8	2.6
Standard deviation	15.8	8.8	14.9	8.7
Excess return		0.8		3.1

* Canada : Long-term SC bond holder indices (1956-1979) and long-term Canada SC (1980-2002).

** United States: Interest rates on federal long-term bonds adjusted for the period (1956-1972) and Lehman Brothers Long Term US Treasury (1973-2002).

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- Actual return on stocks: $RRS_t = DivY_t + RCG_t$

  Where: $DivY_t$: dividend yield

  RCG_t: real capital gains return

- $RGC_t \approx g_{P/E,t} + g_{RE,t}$

  Where: $g_{P/E,t}$: growth in price/earnings multiple

  $g_{RE,t}$: actual earnings growth

	Example 1		Example 2	
	Year 0	Year 1	Year 0	Year 1
P/E	10.0	10.0	10.0	11.0
E	1.0	1.1	1.0	1.0
P	10.0	11.0	10.0	11.0
$g_{P/E,t}$		0%		10%
$g_{RE,t}$		10%		0%
$RCG_t = g_{P/E,t} + g_{RE,t}$		10%		10%

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	S&P/TSX	S&P 500
	Annual average	**Annual average**
Total actual return	**4.5**	**5.8**
Dividend yield	3.2	3.4
Capital gain	1.2	2.3
Breakdown of capital gain		
Actual earnings growth	-0.6	0.5
Changes in price/earnings ratio	1.8	1.9

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- Real growth lag:
    - GDP: 3.3% (1.9% per capita)
    - Earnings (stock market indexes): 1.5%
    - Dividends (stock market indexes): 1.1%

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- ## Has there been a structural change in business distribution policies?

  - ### Replacing dividends with cash through share redemptions in the United States:

    - 4% of earnings in 1972 versus 42% in 2000
    - In 2000, $172 B for dividends versus $194 B for redemptions
    - In 2000, positive net redemptions

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- ## Why has earnings growth lagged behind that of GDP?

  - Transfer of wealth to employees and managers?

  - Earnings of businesses not included in stock market indexes?

  - Problem with calculation of indexes?

    - Discontinuity in earnings and dividends: replacement of value stocks with growth stocks

- ## Choice: real GDP growth (consensus forecast) in order to forecast real earnings growth
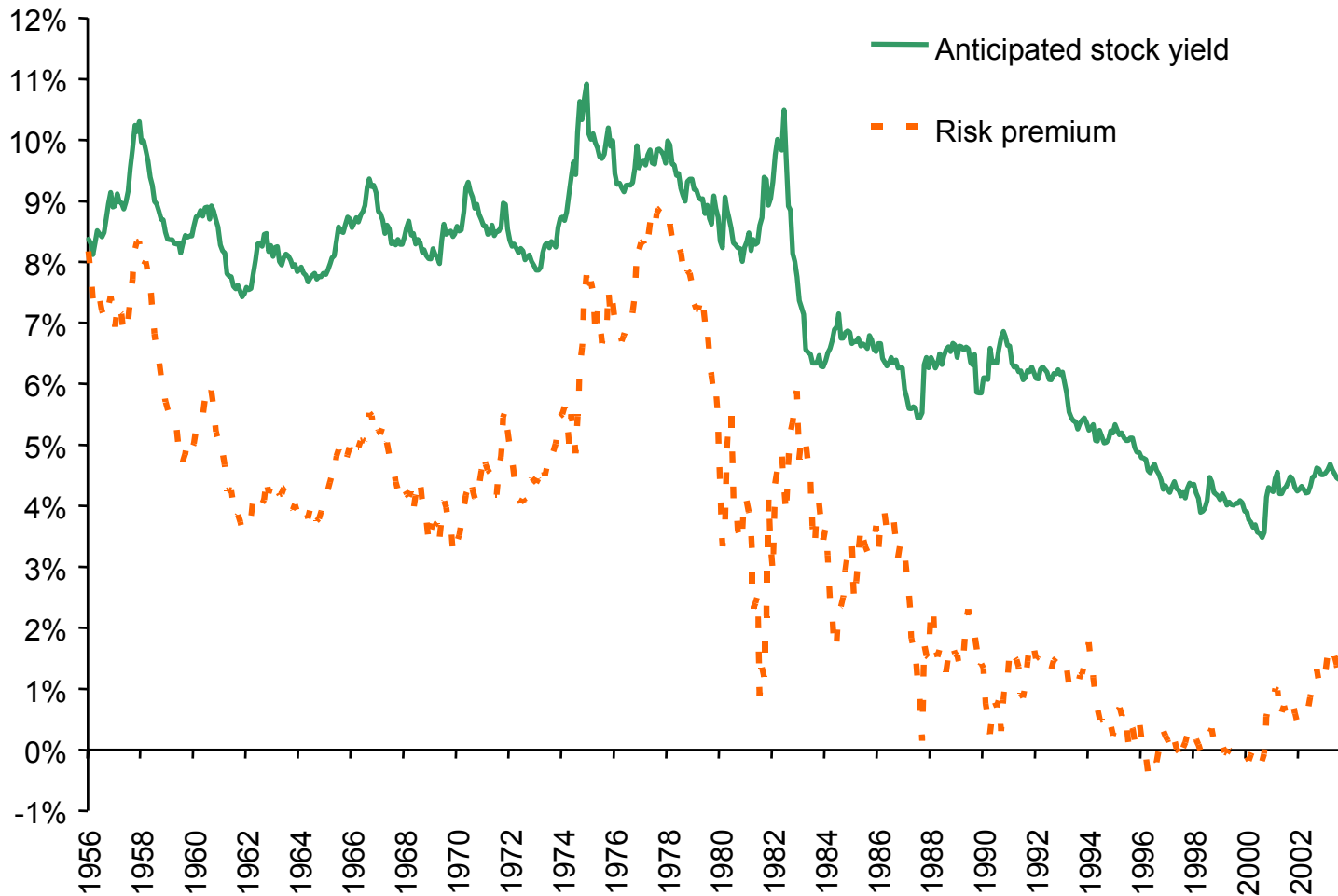
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Dividend yield: 1.8

Real earnings growth:* +2.6

Changes in P/E ratio: +0.0

- Real stock returns: 4.4

- Real bond yields:** 3.1

- Risk premium: 1.3

* Real economic growth and anticipated real earnings growth (estimated by Consensus Economics)
** Rate of return on SC real return bond index

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- Implicit risk premium:

$$v_t = p_t = \sum_{s=1}^{\infty} \frac{FM_{t+s}}{(1+k)^{t+s}}$$

- Example:

P$_{2003}$ = 1000

FM = 80 (perpetuity)

K = 8%

YTM$_{2003}$ = 5%

Premium = 8% - 5% = 3%

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- EBO model:

$$v_t = bv_t + \sum_{s=1}^{\infty} \frac{e_{t+s} - k_t \times bv_{t+s-1}}{(1+k_t)^{t+s}}$$

Where v_t = intrinsic value of index at time t

bv_t = book value of equity at time t

e_{t+s} = earnings projections at time $t+s$

k_t = implicit yield

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	MSCI Canada	% of price	MSCI United States	% of price
Index price	919.6		931.1	
EPS_{t+1}	55.5		50.6	
EPS_{t+2}	63.1		57.1	
EPS_{t+3}	68.5		62.2	
g long term (nomical EPS)	4.7%		4.9%	
bv_t	461.8	50.2%	312.9	33.6%
k_t	**7.8%**		**7.5%**	
YTM_t*	4.9%		4.5%	
$Premium_t$	**3.0%**		**3.0%**	

EPS= Earnings per share

*Rate of return at maturity on 10-year government bonds

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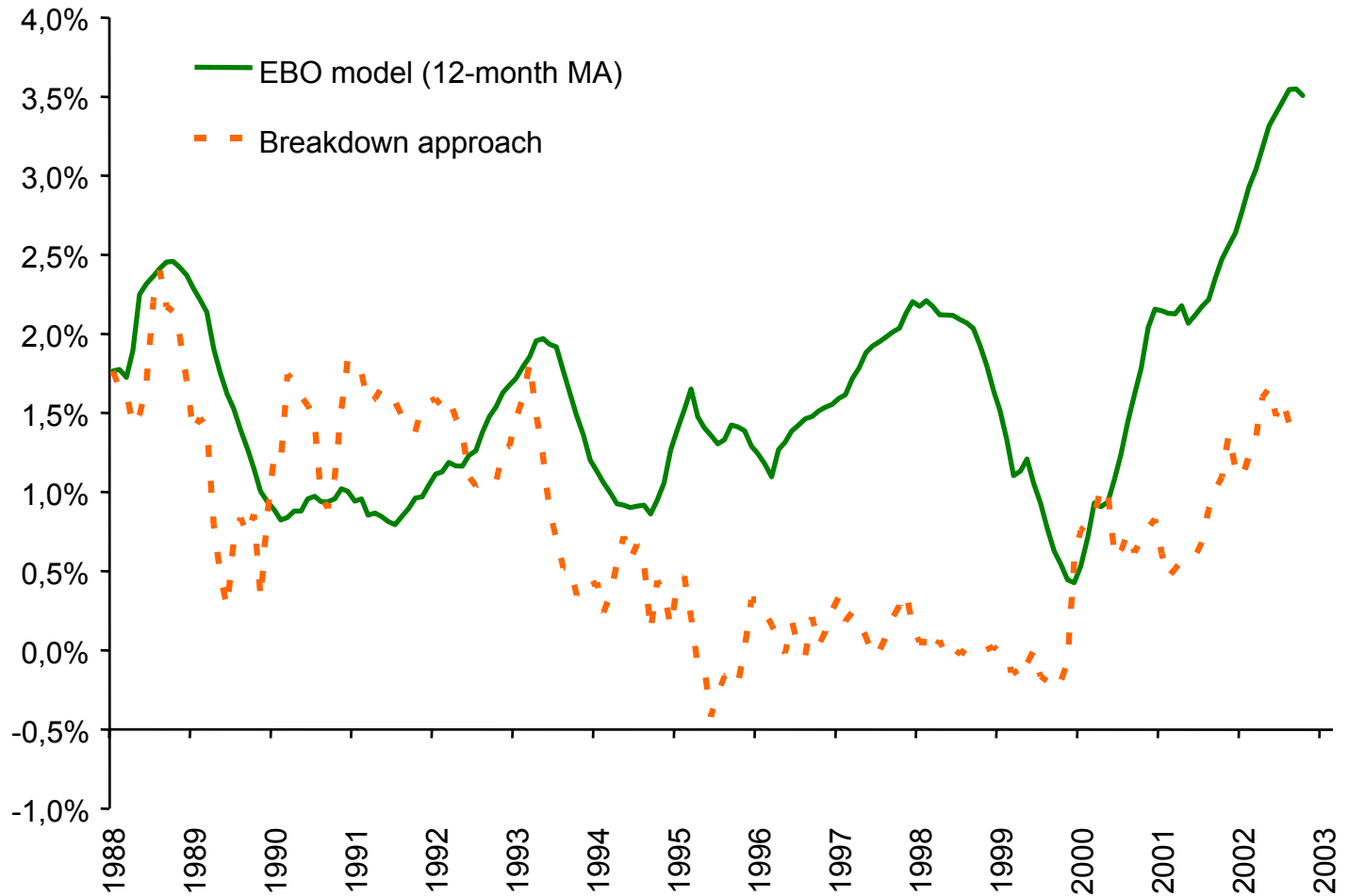
Approach 1: Breakdown of return

- Prospective risk premium =   1.3
- Redemption correction ≈   0.5*

                                                              1,8

Approach 2: Implicit risk premium (EBO)

- Prospective risk premium (12-month MA)=   3.5
- Optimism bias correction (-10%) ≈   -0.7

                                                              2.8

Conclusion: Approach 2 adopted

*See Liang and Sharpe (1999), "Share repurchases and employee stock options and their implications for expected returns".

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Projected Stock Market Returns
EBO Approach in August 2003 – corrected for optimism bias

Percentage	Implicit premium (12-month MA)	Projected local return	Interest rate differential	Projected covered return
Country	(1)	(2)	(3)	(4) = (2) + (3)
Canada	2.8	7.7	0.0	7.7
United States	3.2	7.7	0.4	8.1
United Kingdom	2.2	7.0	0.0	7.0
Germany	4.6	8.8	0.7	9.5
Italy	3.2	7.5	0.7	8.2
France	4.1	8.3	0.7	9.0
Japan	5.1	6.5	3.4	9.9
Australia	2.5	8.0	-0.6	7.4
Netherlands	5.0	9.2	0.7	9.9
Sweden	3.8	8.5	0.2	8.6
EAFE				8.8

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Return and Risk Projection by Asset Class
August 2003

Percentage	Projected return	Projected risk
Short-term securities	3.3	1.0
Bonds	4.6	6.5
Canadian stocks	7.7	16.7
U.S. stocks	8.1	17.8
Foreign stocks	8.8	19.9
Quebec global	9.7	19.8
Shareholdings and infrastructures	9.0	23.4
Private placements	12.0	31.5
Real property	9.0	13.1
Alternative placements	7.3	10.0

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- Shareholdings and infrastructures: historical volatility of S&P/TSX, adjusted for:
    - sectors
    - non-diversification and
    - size

- Private placements: historical volatility adjusted for:
    - size: S&P600
    - sectors: technologies, health and telecommunications
    - leverage: buyouts
    - lack of liquidity

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- Real property: estimated volatility after correction for:
  - smoothing of yield series and
  - leverage (40%)

- Alternative placements: volatility estimated after correction for:
  - smoothing of yield series and
  - operating risk

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Manager's Choice Risk

Percentage

| | Bonds | Canadian stocks | 10 years to June 30, 2003 | | | |
			U.S. stocks	Foreign stocks	Private placements*	Real property	Alternative placements**
1st quartile	8.8	10.7	11.0	8.2	35.6	11.5	15.7
3rd quartile	8.4	8.2	8.0	4.7	(15.1)	5.3	(3.4)
Difference	0.4	2.5	3.0	3.5	50.7	6.2	19.1

Sources: Aon, Venture Economics, RBC , Barron's
*Quartiles calculated over 10 years to December 31, 2002
** Quartiles calculated over 12 months to June 30, 2001

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Estimated Return and Risk of Optimum Portfolios

Asset Optimization

Percentage	Optimal Portfolios			
	6% Risk	**8% Risk**	**10% Risk**	**Maximum Return**
% in variable income securities	41	54	64	75
Assets				
Return on assets	6.1	6.8	7.4	8.0
Asset risk	6.0	8.0	10.0	13.0
Sharpe ratio	0.47	0.44	0.41	0.36
Surplus*				
Surplus yield	0.64	1.31	1.91	2.52
Surplus risk	8.9	9.5	11.1	13.9

Liabilities are represented by the long-term SC index, YTM = 5.5% and DM = 12.

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Probabilities Related to Certain Return Thresholds

Asset Optimization

Percentage	Optimum Portfolios			
	6% Risk	**8% Risk**	**10% Risk**	**Maximum Return**
% in variable income securities	41	54	64	75
One-year horizon				
Greater than 10%	26	35	40	44
Less than 4%	36	36	37	38
Less than 0%	15	20	23	27
Five-year horizon				
Greater than 10%	8	19	28	37
Less than 4%	21	22	22	24
Less than 0%	1	3	5	8

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Probabilities Related to Certain Thresholds
Asset/liability ratio (surplus) - Asset optimization

Percentage	Optimum Portfolios			
	6% Risk	**8% Risk**	**10% Risk**	**Maximum Return**
% in variable income securities	41	54	64	75
One-year horizon				
Ratio greater than 1.1	15	18	23	29
Ratio less than 0.9	12	12	14	18
Five-year horizon				
Ratio greater than 1.2	20	27	34	41
Ratio less than 0.9	25	22	21	23

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Asset Optimization Versus Surplus Optimization

Percentage	Optimum Portfolios			
Asset optimization				
% in variable income securities	41	54	64	75
Asset risk	6.0	8.0	10.0	13.0
Return on suprlus	0.64	1.31	1.91	2.52
Surplus risk	8.9	9.5	11.1	13.9
Surplus optimization				
% in variable income securities	50	55	68	75
Asset risk	8.7	9.4	11.2	13.0
Return on suprlus	1.44	1.64	2.12	2.52
Surplus risk	8.9	9.5	11.1	13.9

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- International diversification easier:
    - Lower risk premium than in the past
    - Risk premium parity across liquid markets (arbitrage for same risk level)

- Sectoral premiums versus country premiums?

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- Negative factors:
    - Lower GDP and earnings growth
    - Sale of risky assets:
        - Risk reduction
        - Consumption
- Highly attenuating factors:
    - Uncertainty over life expectancy: wealth at death
    - Rising age of retirement
    - In an inflationary environment, stocks perform better than bonds
    - Immigration/emigration
    - Emerging countries: global manufacturing

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- Anticipated share premium is in the order of 3%.

- Increase variable income securities from 0% to 50%:
  - approximate 2% increase in return,
  - surplus risk reaches 9.5%.

- Non-traditional assets (real property, private placements and hedge funds) appear more promising than stocks, but introduce a significant "manager's choice" risk

- Aging population: negative impact on yields attenuated by economic and demographic factors

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Annexes

Composition of Optimum Portfolios for Various Risk Levels

Percentage	Optimum Portfolios			
	6% Risk	**8% Risk**	**10% Risk**	**Maximum Return**
Short-term securities	5.8	0.0	0.0	0.0
Bonds	52.8	45.5	36.1	25.0
Fixed income securities	**59**	**46**	**36**	**25**
Canadian stocks	12.3	14.7	11.9	15.0
U.S. and foreign stocks	4.4	4.0	7.9	20.0
Quebec global	0.0	10.0	10.0	10.0
Shareholdings and infrastructures	0.0	1.4	4.5	10.0
Private placements	4.7	4.4	9.5	10.0
Real property	10.0	10.0	10.0	10.0
Alternative placements	10.0	10.0	10.0	0.0
Variable income securities	**41**	**54**	**64**	**75**

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Composition of Optimum Portfolios for Various Risk Levels

Percentage	Optimum Portfolios			
Surplus risk of	**8.9**	**9.5**	**11.1**	**13.9**
Short-term securities	0.0	0.0	0.0	0.0
Bonds	49.9	44.7	32.0	25.0
Fixed income securities	**50**	**45**	**32**	**25**
Canadian stocks	0.0	0.0	0.0	15.0
U.S. and foreign stocks	5.2	8.7	18.0	20.0
Quebec global	10.0	10.0	10.0	10.0
Shareholdings and infrastructures	4.9	6.5	10.0	10.0
Private placements	10.0	10.0	10.0	10.0
Real property	10.0	10.0	10.0	10.0
Alternative placements	10.0	10.0	10.0	0.0
Variable income securities	**50**	**55**	**68**	**75**

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Optimization Constraints

Percentage	Lower thresholds	Upper thresholds
Short-term securities	0	20
Bonds	25	70
Canadian stocks	0	40
U.S. and foreign stocks	0	30
Quebec global	0	10
Shareholdings and infrastructures	0	10
Private placements	0	10
Real property	0	10
Alternative placements	0	10

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Correlation Matrix

Percentage	Bonds	Canadian stocks	U.S. stocks	Foreign stocks	Quebec global	Shareholdings & infr.	Private placements	Real property
Canadian stocks	0.1	1.0						
U.S. stocks	0.5	0.6	1.0					
Foreign stocks	0.2	0.7	0.7	1.0				
Quebec global	0.6	0.7	0.9	0.9	1.0			
Shareholdings and infrastructures	0.3	0.7	0.6	0.6	0.6	1.0		
Private placements	0.1	0.8	1.0	0.8	0.9	0.7	1.0	
Real property	(0.6)	(0.1)	(0.1)	0.2	(0.1)	0.0	0.1	1.0
Alternative placements	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.0

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