

Liability Driven Investing in Charles River IMS

Innovation in liability-driven investing (LDI) continues to drive the adoption of investment solutions and risk management approaches by pension plans. With the recent strong equity market performance improving their funded status, many plans are adopting a more dynamic approach and moving down the glidepath to further derisking.^[1]

LDI workflows leverage existing Charles River Investment Management Solution ([Charles River IMS](#)) capabilities including [Charles River Manager Workbench](#), analytics, security master creation with out-of-the box configurations, and streamlined setup to help minimize implementation time.

LDI Workflow Overview



Import
Liabilities



Calculate
Analytics
& Measure
Sensitivities



Manage Portfolio
of Assets &
Liabilities



Monitor
Compliance

LDI Workflow Support



Liability Benchmarks and Liability Mapping

Users can manage, monitor and mitigate asset portfolio risk relative to a set of nominal and/or inflation adjusted liabilities.



Analytics, Inflation Sensitivities and Liability Discounting

Liability valuations are calculated relative to the appropriate cash flows, curves (e.g., IRS curve) and spread. Rate and Inflation sensitivities are captured using flexible tenor set definitions.

Liability valuations can be performed relative to regulatory curves. From these valuations, spreads to market curves can be measured (e.g. spread to treasuries or swaps). Additionally, for managers with access to both real and nominal cash flows, Charles River will enable users to derive an implied term structure of inflation from real vs. nominal liabilities (e.g. liability implied inflation curve).

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The sets feature:

- Flexible tenor definitions
- Ability to generate interest rate and inflation sensitivities per tenor (i.e., KRDs, PV01 and IE01)*
- Calculation of implied inflation exposures for nominal bonds

At-a-glance PV01 comparison between assets and liabilities in Manager Workbench

Security	PV01 by tenor														
	6M	1Y	2Y	3Y	5Y	7Y	10Y	15Y	20Y	25Y	30Y	35Y	40Y	45Y	50Y
Positions Grand Total	(335)	1,214	7,637	3,432	3,992	15,832	(58,492)	(53,382)	40,778	11,417	64,620	(6,367)	(10,749)	(5,121)	(1,119)
LDI Demo	(335)	1,214	7,637	3,432	3,992	15,832	(58,492)	(53,382)	40,778	11,417	64,620	(6,367)	(10,749)	(5,121)	(1,119)
Assets	1,109	5,869	18,792	31,400	54,901	89,079	45,244	75,452	143,815	91,409	109,889	14,114			
Inflation Linked	10	40	1,030	3,387	1,671	20,889	4,535	800	3,697	16,898	4,836				
Nominal	1,099	5,829	17,762	28,013	53,230	68,191	40,709	74,652	140,118	74,511	105,053	14,114			
Liabilities	(1,444)	(4,655)	(11,155)	(27,968)	(50,909)	(73,247)	(103,736)	(128,834)	(103,037)	(79,992)	(45,269)	(20,481)	(10,749)	(5,121)	(1,119)
Inflation Linked	(457)	(1,358)	(3,136)	(8,211)	(15,954)	(19,875)	(2,136)								
Nominal	(987)	(3,297)	(8,019)	(19,757)	(34,955)	(53,372)	(101,601)	(128,834)	(103,037)	(79,992)	(45,269)	(20,481)	(10,749)	(5,121)	(1,119)

Screenshots are for informative purposes only. No live data being used.



Portfolio Management, Optimization and Performance Attribution

The Charles River **Manager Workbench** enables users to efficiently manage a portfolio of assets against a set liabilities. Portfolio managers can interact with liability securities, calculate and manage funding ratios, and generate risk ladders including interest rates, inflation and cash flow shortfalls. This empowers managers to mitigate multiple dimensions of risk via hedging and targeting workflows, for example, hedging a position and determining funding ratio impact.

Managers can use optimization to determine appropriate hedge ratios and asset allocations using their preferred third-party optimizers directly from the Manager Workbench. Optimization capabilities include the ability to target KRD / PV01 tenors, and create an investible representation of liabilities that can be used throughout the product in a more meaningful way than liabilities alone (e.g. tracking error and attribution analysis).

Standard measures of performance against liability benchmarks can be calculated to determine the impact of spread, interest and inflation rate changes on the LDI portfolio. Excess returns versus liability benchmarks can be attributed between active manager positioning and portfolio positioning to provide insight into performance drivers. Managers can also view performance comparisons between assets and liabilities.



Scenario Analysis, Regulatory Reporting and Compliance

Charles River **Scenario Analysis** supports the ability to shift the market factors that are relevant to liabilities (e.g., interest rates, inflation and spreads). Shifts are applied to all relevant curves, liability, and asset attributes in order to obtain a scenario specific set of valuations, returns, analytics and cash flows. Managers can also validate hedges under stressed conditions before constructing and executing the hedge.

From a fund management perspective, this allows a portfolio manager to:



View funding and hedge ratios subject to various economic environments



Perform cash ladder analysis relative to their liabilities



Analyze changes in valuations and sensitivities subject to regime changes

Modeling cash flow scenarios

Scenario Cash flows						
Baseline Horizon on 4/10/2022						
Security	Principal	Income	Reinv Int	Cash Rcvd	Bmk Liability	Shortfall/Surplus
Positions Grand Total	63,000,000	39,428,805	988,518	103,417,323	111,995,895	(8,578,572)
LDI Demo	63,000,000	39,428,805	988,518	103,417,323	111,995,895	(8,578,572)
6/30/2020	0	4,688,985	88,500	4,777,485		4,777,485
Assets	0	4,688,985	88,500	4,777,485		4,777,485
9/30/2020	0	5,417,857	91,988	5,509,845	7,719,359	(2,209,514)
Assets	0	5,417,857	91,988	5,509,845		5,509,845
Liabilities					7,719,359	(7,719,359)
12/31/2020	21,000,000	4,688,985	332,539	26,021,524	37,252,670	(11,231,146)
Assets	21,000,000	4,688,985	332,539	26,021,524		26,021,524
Liabilities					37,252,670	(37,252,670)

For stress testing, liabilities can be proxied or used in factor scenarios if factor exposures are available. The deterministic scenario set known as New York 7 (NY7) used for the SOA Asset Adequacy Analysis is supported. Templates are provided to streamline regulatory reporting requirements for Solvency II, S&P convexity risk and AM Best.

Charles River's end-to-end compliance engine enables compliance rules to be based on portfolio level analytics, tenors and funding ratio.

Glide Path Support

Asset owners may use a dynamic de-risking asset allocation strategy, or "glide path", to gradually shift out of return-seeking strategies that rely on equity exposure into liability-hedging long duration fixed income strategies. Glide path workflows are supported to help managers determine the appropriate asset allocations as plan funding status changes.

"Time Travel"

Charles River archives liability data as a time series, allowing managers to recalculate liabilities for a prior month end and compare them to current values. Time series comparisons can be made of assets relative to liabilities, and analytics can be replayed interactively for any desired date.

Productivity Enhancements

Ongoing productivity enhancements streamline LDI workflows in Charles River IMS:

Expanded visualization capabilities
enable user to chart sensitivities of both assets and liabilities as the same bar.

Liability cash flows can be imported
from third-party actuarial vendors into Charles River IMS.

Screenshots are for informative purposes only. No live data being used.

Charles River Development, A State Street Company

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Learn more at crd.com/pmrisk

[1] <https://www.pionline.com/ldi-risk-report2021>

*KRD (Key Rate Duration): measures how the value of a security or portfolio changes at a specific maturity point along the entirety of the yield curve. When keeping other maturities constant, the key rate duration can be used to measure the sensitivity in a security's price to a 1% change in yield for a specific maturity.

PV01: the change in present value of an asset or liability for a 1 basis point change in the nominal yield curve used to value the asset or liability (usually the swap curve)

IE01: the change in present value of an asset or liability for a 1 basis point change in the implied inflation curve used to value the asset or liability (usually the RPI zero-coupon curve).

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