

A TECHNICAL ASSESSMENT OF MODELING STRUCTURED ASSETS WITHIN THE C1 FRAMEWORK

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Bridgeway Analytics

OVERVIEW

Background

- Regulatory Issue – An insurer that purchases every tranche of a CLO holds the exact same investment risk as if it had directly purchased the entire pool of loans backing the CLO. The aggregate risk-based capital (RBC) factor for owning all of the CLO tranches should be the same as that required for owning all of the underlying loan collateral. If it is less, it means there is risk-based capital (RBC) arbitrage.
- NAIC Staff Recommendation - The Valuation of Securities (E) Task Force initiate and approve the assignment of NAIC Designation Categories to CLOs modeled by SSG to eliminate this RBC arbitrage. ([VoSTF Materials](#))
- Public comments - suggest consensus the need to design an arbitrage-free framework that considers the different risk profiles across asset classes. Questions remain on which risks and offsets should be considered in the modeling. The current RMBS & CMBS (non-legacy) approach has been a point of reference for CLOs.

Agenda

- An overview of the C1 Framework, appropriate use and limitations
- An overview of the RMBS & CMBS intrinsic price approach
- An assessment of key modeling features and their materiality when Attempting to level-set capital across asset classes using different modeling frameworks

OVERVIEW

Aspiration of Level-Setting Risk Charges Across Assets

- RMBS & CMBS aside, RBC credit charges rely on NAIC designations that are mostly determined by NRSRO ratings.
- What are ratings?
 - Moody's, S&P and other NRSRO ratings are horizon free ordinal opinions
 - They are not cardinal (like the c1 factors) and it is acknowledged that different factors affect different asset classes differently over time and to a varying degree
- The ratings process
 - Combination of quantitative and qualitative approaches, that generally do not rely on any single method
 - Approach to structured assets is often more quantitative, with reliance on both simulation-based approaches, as well as on macro-scenario stress testing, with qualitative overlays. Qualitative reviews can result in notching and helps avoid Goodhart's law
 - Governance, including well documented model methodology and performance is heavily regulated
- Challenges with rating agencies aspirations for equivalence across assets (Moody's Analytics, ["Assessment of the Proposed Revisions to the RBC C1 Bond Factors"](#) prepared for the NAIC and ACLI)
 - Municipal vs Corporate Credit. The ten-year cumulative default rate for investment-grade global corporate (2.25%) is significantly higher than that of municipal credits (0.1%). For speculative-grade, the CDR of global corporate (28.68%) is about four times the value of municipal credits (7.29%). Average municipal recoveries have been about 68%, compared to 47.7% for senior unsecured bonds of North American
 - CLOs vs Corporate. While Moody's Investors Service (MIS) aspires to achieve broad equivalence, structured finance ratings are differentiated with an added (sf) to eliminate any presumption that the same letter grade level will behave the same. IG and SG CLO default rates have been noticeably lower than corporate bonds since the early 90s, including through the financial crisis. IG (HY) LGD has been lower (higher) than what has been observed for corporate bonds

C1 FRAMEWORK

"The C1 base factor for each... rating category... represents the amount of initial funds needed to cover the 96th percentile greatest default loss over 10 years, offset by the portion of default loss already anticipated in statutory reserves... [It represents] the maximum 10-year cumulative portfolio loss, which considers recoverable tax on default loss and accumulated... offsets." (1)

Appropriate Use

- Describe the historical loss experienced by MIS rated 10-year corporate bonds, and considers offsets

Limitations with the c1 framework (2)

- Does not consider remaining maturity. An equal designated 2-year credit is associated with the same level of lifetime loss, and capital, as a 10- or 30-year credit.
- Does not differentiate differing risks across asset classes that have experienced substantially different historical default rates and recovery.
- Does not consider variation in spreads across asset classes that can have a substantial impact on offsets.
- Only considers credit risk.

1. Moody's Analytics, "[Revisions to the RBC C1 bond Factors Prepared for the NAIC and ACLI](#)" April 2021.
2. Moody's Analytics, "[Assessment of the Proposed Revisions to the RBC C1 Bond Factors](#)" prepared for the NAIC and ACLI in February 2021.

CMBS & RMBS INTRINSIC PRICE APPROACH (NON-LEGACY)

Assigning designations

- Intrinsic Price is an output of financial modeling, defined as ‘1 – weighted average of discounted principal loss’ expressed as a percentage, reflecting the credit risk of the security. (1)
- The scenarios and their weights are reported by the SSG (the four 2021 YE scenarios can be found [here](#))
- Intrinsic price is mapped to NAIC designations (1) and (2)
- In spirit, the ‘weighted average of discounted principal loss’ is mapped to RBC

Alignment with the C1 framework

- **Maturity.** The intrinsic price measures lifetime expected discounted loss on principle. All else equal, and discounting aside, a lower capital charge will be assigned shorter dated assets with low lifetime loss.
 - The C1 framework does NOT differentiate a 2-year and 30-year credit which is an acknowledged shortcoming. This disconnect can result in distortions in the context of managed structured assets where the collateral is shorter dated (lower lifetime loss) 10-year corporate bonds (e.g., 5–7-year loans).
 - Other regulatory capital frameworks such as Basel A-IRB include effects of lifetime credit loss.
- **Reserving/Risk Premium.** The C1 factors are measured in excess of statutory reserves (also referred to as the Risk Premium) since they complement absorbing future credit losses. Because of its materiality, calibration of the Risk Premium was heavily debated when the C1 factors were redesigned in 2021. For context, the Baa3 pre-tax C1 bond factor, is 2.17%, and is net of its Risk Premium of roughly 0.36% (~15% of the capital charge).
- **Offsets.** The C1 factors are measured in excess of offsets that can impact lifetime loss substantially, with different asset classes potentially having different payout profiles. AAA-A rated CLO tranches, for example, can offer additional spreads in the range of 70-120 bps over equally rated corporate bonds ([CLOs: Benefits and Risks](#), March 2022).

1. [Purposes & Procedures Manual of the NAIC Investment Analysis Office](#)
2. [Designation Assignment to Mortgage-Referenced Securities](#)
3. Moody’s Analytics, [“Assessment of the Proposed Revisions to the RBC C1 Bond Factors”](#) prepared for the NAIC and ACLI in February 2021.

Mortgage-Referenced Securities (2)
Mapping of Intrinsic Price to Designation

Asset Class	AVR (pre-tax) Factor	AVR (pre-tax) Factor Midpoint	Minimum Final Intrinsic Price
NAIC 1	0.4%	0.85%	99.15%
NAIC 2	1.3%	2.95%	97.05%
NAIC 3	4.6%	7.30%	92.70%
NAIC 4	10.0%	16.50%	83.50%
NAIC 5	23.0%	26.50%	73.50%
NAIC 6	30.0%		

INTRINSIC PRICE BASED DESIGNATIONS CAN BE MORE FAVORABLE FOR ASSETS WITH SHORTER MATURITIES

Table 26

Global Corporate Average Cumulative Default Rates By Rating Modifier (1981-2020) (%)															
--Time horizon (years)--															
Rating	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
AAA	0.00	0.03	0.13	0.24	0.34	0.45	0.51	0.59	0.64	0.70	0.72	0.75	0.78	0.84	0.9
AA+	0.00	0.05	0.05	0.10	0.15	0.20	0.25	0.31	0.36	0.42	0.48	0.53	0.59	0.66	0.7
AA	0.02	0.03	0.08	0.21	0.35	0.47	0.59	0.70	0.78	0.87	0.95	1.00	1.10	1.16	1.2
AA-	0.03	0.08	0.16	0.23	0.31	0.41	0.47	0.52	0.57	0.62	0.68	0.73	0.75	0.80	0.8
A+	0.05	0.09	0.19	0.31	0.41	0.50	0.60	0.71	0.83	0.96	1.08	1.21	1.36	1.54	1.6
A	0.05	0.14	0.21	0.32	0.44	0.61	0.78	0.94	1.11	1.32	1.48	1.68	1.72	1.79	1.9
A-	0.06	0.16	0.25	0.36	0.51	0.66	0.87	1.03	1.15	1.27	1.37	1.50	1.62	1.74	1.8
BBB+	0.09	0.26	0.47	0.67	0.90	1.15	1.35	1.56	1.82	2.07	2.30	2.46	2.64	2.87	3.1
BBB	0.15	0.37	0.59	0.93	1.27	1.62	1.94	2.24	2.56	2.88	3.22	3.49	3.72	3.82	4.0
BBB-	0.24	0.69	1.27	1.93	2.63	3.24	3.78	4.28	4.69	5.04	5.43	5.75	6.05	6.51	6.8
BB+	0.32	0.97	1.76	2.55	3.35	4.14	4.82	5.32	5.92	6.52	6.93	7.42	7.92	8.27	8.8
BB	0.48	1.52	2.96	4.34	5.76	6.88	7.92	8.81	9.67	10.43	11.25	11.86	12.34	12.68	13.
BB-	0.96	2.92	5.01	7.15	9.03	10.83	12.34	13.78	14.92	15.92	16.68	17.46	18.21	18.94	19.
B+	1.98	5.42	8.82	11.73	14.02	15.80	17.43	18.86	20.17	21.37	22.41	23.14	23.92	24.65	25.
B	3.13	7.35	11.11	14.19	16.69	18.97	20.62	21.87	23.07	24.26	25.02	25.78	26.37	26.89	27.
B-	6.52	13.69	19.28	23.16	25.97	28.07	29.63	30.86	31.72	32.45	33.61	34.32	34.89	35.46	35.
CCC/C	28.30	38.33	43.42	46.36	48.58	49.61	50.75	51.49	52.16	52.76	53.21	53.68	54.23	54.69	54.
Investment grade	0.09	0.24	0.41	0.63	0.86	1.09	1.30	1.50	1.69	1.88	2.05	2.20	2.35	2.49	2.6
Speculative grade	3.71	7.19	10.18	12.63	14.64	16.30	17.68	18.83	19.86	20.81	21.61	22.29	22.93	23.49	24.
All rated	1.53	3.00	4.27	5.35	6.25	7.01	7.64	8.18	8.67	9.12	9.50	9.83	10.13	10.41	10.

Assessing the impact of maturity on expected lifetime discounted principal loss that is used in assigning designations

- As a point of reference, 2-year BB corporate bond default rates (1.5%) are somewhere in the 10-year A range (1.3%).
- C1 factors do not differentiate expected loss across maturity

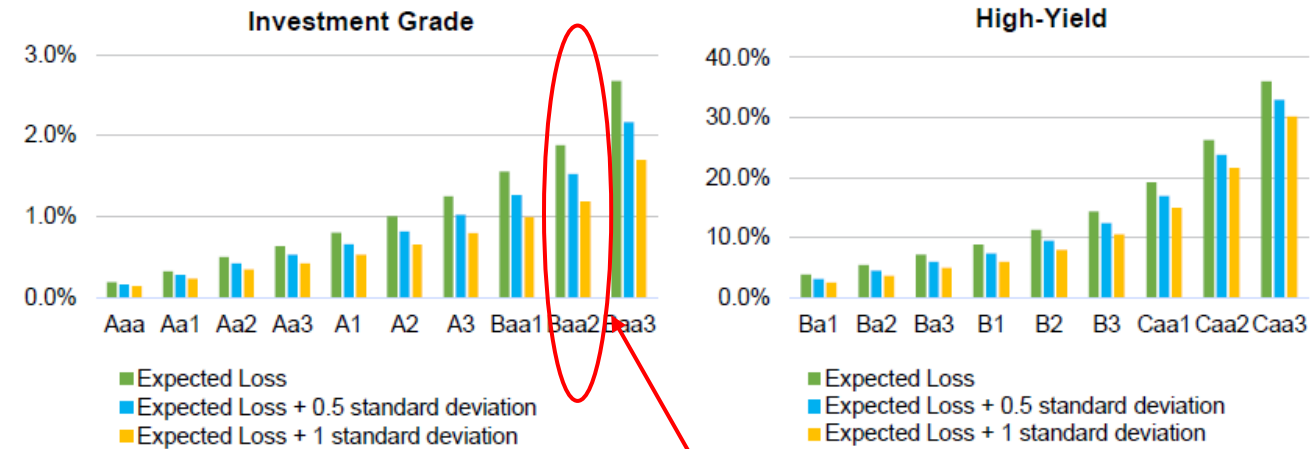
S&P Global Ratings, “[Default, Transition, and Recovery: 2020 Annual Global Corporate Default And Rating Transition Study](#)” April 2021.

INTRINSIC PRICE BASED DESIGNATIONS IMPROVE WHEN ACCOUNTING FOR THE RISK PREMIUM

Table 7: Implied Loss Percentiles and Risk Premium Under MA's Correlation Model

MIS Rating ¹⁶	Expected Loss		Expected Loss + 0.5 Standard Deviation		Expected Loss + 1 Standard Deviation	
	Value	Loss Percentile	Value	Loss Percentile	Value	Loss Percentile
Aaa	0.003%	75.0%	0.007%	83.7%	0.011%	89.7%
Aa1	0.008%	66.4%	0.015%	79.9%	0.021%	87.5%
Aa2	0.022%	61.4%	0.032%	76.0%	0.042%	85.8%
Aa3	0.032%	59.2%	0.046%	75.2%	0.059%	85.7%
A1	0.048%	58.5%	0.065%	74.8%	0.082%	85.3%
A2	0.070%	57.5%	0.092%	74.0%	0.113%	85.0%
A3	0.096%	57.2%	0.123%	74.4%	0.150%	85.5%
Baa1	0.134%	56.7%	0.168%	73.4%	0.202%	85.4%
Baa2	0.187%	55.1%	0.229%	73.1%	0.271%	85.1%
Baa3	0.303%	55.4%	0.362%	73.3%	0.421%	84.7%
Ba1	0.493%	55.0%	0.579%	72.6%	0.665%	84.8%
Ba2	0.809%	54.0%	0.932%	71.8%	1.055%	84.8%
Ba3	1.071%	54.5%	1.225%	72.4%	1.379%	84.7%
B1	1.429%	53.9%	1.619%	72.2%	1.809%	84.7%
B2	1.933%	53.2%	2.168%	71.5%	2.404%	84.7%
B3	2.545%	52.9%	2.834%	71.4%	3.123%	84.9%
Caa1	3.424%	53.0%	3.787%	71.3%	4.151%	84.1%
Caa2	4.816%	52.4%	5.274%	70.8%	5.731%	84.1%
Caa3	7.406%	51.9%	7.998%	70.2%	8.591%	83.9%

Figure 24: C1 Base Factors for different levels of Risk Premium



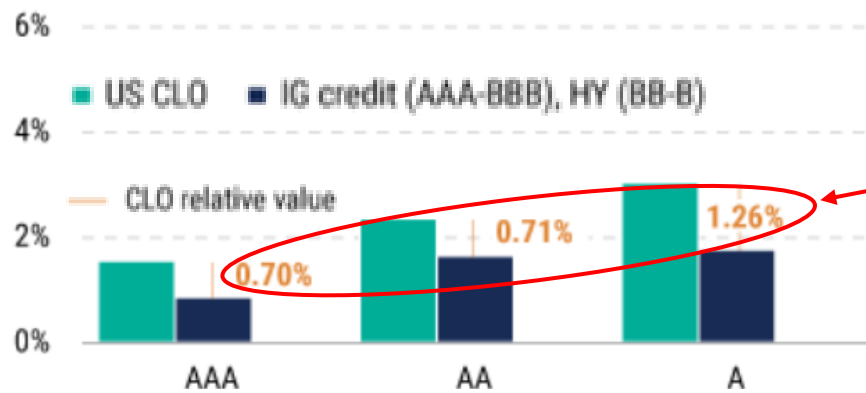
The C1 framework are measured net of reserves (using the Risk Premium terminology)

- Reserves act as an additional buffer, and when accounted for lower the capital factor
- The Baa3 c1 bond factor, for example, is 2.168%, with the Risk Premium of Expected Loss + 0.5 SD of 0.362%, or ~15% of the capital charge

Moody's Analytics, "[Revisions to the RBC C1 bond Factors Prepared for the NAIC and ACLI](#)" April 2021.

ACCOUNTING FOR OFFSETS

CLO spreads versus comparably rated corporate bonds (1)



Source: JP Morgan, Bloomberg, and S&P/LCD as of 31 August 2021. US CLO debt represented by the JP Morgan CLOIE Index; IG credit: Bloomberg US Credit Index; High yield bonds: Bloomberg US Corporate High Yield Bond Index; Leveraged loans: S&P/LSTA Leveraged Loan Index.

Income Offsets

- Act as an additional buffer, and when accounted for lower the capital factor
- For CLOs for example, the additional 70-126bps in added spread for A-AAA tranches (2) can have a material impact on offset tail loss, with pre-tax c1 factors ranging from 16bps for AAA to 102bps for A3 (2)

1. PineBridge Investments, [CLOs: Benefits and Risks](#), 02 March 2022
2. Moody's Analytics, "[Revisions to the RBC C1 bind Factors Prepared for the NAIC and ACLI](#)" April 2021.

IN THE NEWS & IN PRINT*

INSURANCE ASSET RISK
Asia Pacific Managers Regulation Risk SAA/ALM

22 April 2022

Comment: The future of ETF use - lessons from the past

Channels: Risk, SAA/ALM, USA focus
Companies: Bridgeway Analytics
People: Amnon Levy

Since the financial crisis and the advent of low interest rates, insurers have adopted a broad set of investment strategies that include increased exposure to higher yielding private credit, and more active management of their liquid portfolios. ETFs facilitate this latter opportunity, with their use increasing noticeably over the last several years, as highlighted in ETFs in Insurance General Accounts - 2021.

Favorable regulatory and accounting treatment, and general familiarity with the asset class has led to increased incorporation of ETFs into portfolios of their evolving investment mandates. ETFs are

INSURANCE ASSET RISK

Top Story

NAIC requests feedback on RBC treatment of asset backed securities

Further differentiation of risk across credit holdings needed,...

Channels: Regulation, Risk, SAA/ALM, USA focus

<https://www.insuranceassetrisk.com/naic-requests-feedback-on-rbc-treatment-of-asset-backed-securities.html>

Amnon Levy's interview with IAR Editor Vincent Huck exploring needed further refinements to the RBC allowing for more differentiation across credit holdings

Asset-Backed Alert
THE WEEKLY UPDATE ON WORLDWIDE SECURITIZATION

Green Street

Startup Carries On Insurance Work

The former leader of a **Moody's Analytics** team that aided in redesigning regulatory guidelines for insurers' credit-product investments is starting his own research and consulting firm.

Following **Amnon Levy's** August departure from Moody's Analytics, several life insurers approached him about potential engagements. The interest came as many groups within the **National Association of Insurance Commissioners** began talking about further refinements to risk-based capital requirements the organization adopted in June with assistance from Levy's former group.

Bridgeway Analytics, the firm Levy co-founded last month, now is negotiating its first contracts.

Bridgeway Analytics and its management team recently showcased in Green Street's Asset-Backed Alert

FINANCIAL TIMES

HOME WORLD US COMPANIES TECH MARKETS CLIMATE OPINION WORK & CAREERS LIFE & ARTS HOW TO SPEND IT

Company Announcements

Moody's Corp

Moody's Analytics and ACLI Support Revised Regulatory Capital Requirements Adopted by the NAIC for US Life Insurers

JULY 22, 2021

NEW YORK--(BUSINESS WIRE)--Jul. 22, 2021-- Moody's Analytics and the American Council of Life Insurers (ACLI) commend the recent adoption by the National Association of Insurance Commissioners (NAIC) of revised risk-based capital (RBC) factors for bond investments.

Amnon Levy led the team that redesigned the NAIC c1 factors that governing \$3 trillion in US insurers' credit assets

An important milestone and a testament to consensus building through collaboration with the NAIC, ACLI, the insurance industry and regulators.

INSURANCE ASSET RISK

Amnon's piece on liability aware investment strategies

Bestsellers

Still a bestseller! Amnon's book on credit risk measurement and management

Credit Risk Measurement and Management: Disruption and Evolution
EDITED BY AMNON LEVY AND BING ZHANG

Senior Investment Managers Seminar 2021
November 7-10

MARANA, ARIZONA
The Ritz-Carlton, Dove Mountain

ACLI

Amnon and other panelists discussed implications of the adopted c1 factors

* See Amnon Levy's comprehensive list of publications, including technical material here: <https://www.linkedin.com/in/amnon-levy-01a1108/>

AMERICAN BANKER

LEADERS POLICY & REGULATION COMMUNITY BANKING CREDIT UNIONS MORE

CECL

BankThink Nonbank players are ready for CECL — are banks?

By Amnon Levy August 15, 2019, 9:00 a.m. EDT 3 Min Read

As debates rage over the incoming current expected credit loss standard, it has achieved the rarest of feats in today's political environment: bipartisan accord, however dubious it may be.

Lawmakers from both sides of the aisle have expressed concerns about the unintended consequences of the new standard on financial institutions, consumers and the economy as a whole. These concerns have merit, as some of the externalities stemming from the standard may prove unpalatable for certain market participants.

Amnon's thought piece on the impact of accounting standard on credit portfolio management

Regulatory constraints
How increased requirements are evolving CPM

Amnon Levy, managing director and head of portfolio and balance sheet research at Moody's Analytics, discusses the evolving expectations of institutions for credit portfolio management, as well as how it is being altered and adapted amid greater impact from new regulatory and technological advancements

Capital and liquidity requirements for credit portfolio management (CPM) have significantly increased since the global financial crisis—how are institutions adapting and what challenges exist in doing so?

Amnon Levy: Firms have been increasingly constrained by the regulatory environment, driving them to adapt their businesses to be more sensitive to heightened requirements. Dealing with multiple regulatory constraints while maximising value is a multifaceted problem. An institution must have the financial-statement data limited in many emerging economies, there have been efforts to better understand what can be said of the variation in correlations across different economies. Using data in more developed credit markets, one observes a strong relationship between correlations and GDP per capita. This relationship can be used to extrapolate and infer correlations for developing regions. In addition, one can leverage cross-sectional variations in correlations observed in developed credit markets. In the context of IFRS 9, this technique has been instrumental in linking C&I

Designing regulatory capital aware investment strategies



The Changing Climate of Credit Risk Management ABA Banking Journal - Why credit investors need to focus more on climate risk



The Hope and Challenge of Vaccines: Implications for Credit Loss Forecasting GARP
Designing credit models in the face of emerging threats

BRIDGEWAY ANALYTICS SENIOR TEAM MEMBERS



Amnon Levy, Chief Executive Officer. Inspired by everchanging financial markets, Amnon founded Bridgeway Analytics to redefine how institutional investors make investment decisions. Bridgeway Analytics offers solutions that improve efficiency and income generation by bridging practitioner needs for accelerated tactical and strategic decisioning with practical performance metrics. With a passion for best in-class analytics, Amnon Levy has led the development of award-winning quantitative solutions actively used by the investment, lending, risk, ALM, treasury, and financial reporting functions at 200+ banks, insurance companies, pension funds, and asset managers. Amnon has led numerous initiatives that improve on industry best practices and regulation, including the 2021 redesigned NAIC regulatory guidelines for life insurance ~\$3 trillion credit holdings. This was an important milestone with consensus formed across the NAIC, ACLI, the insurance industry and regulators, and a testament to his collaborative-style.



Luis Leguizamon, Chief of Market Strategy and Client Solutions. For over two decades Luis has been partnering with financial institutions, as he led business development and marketing strategies, supporting their adoption of technology platforms and predictive analytics. His deep understanding of the tools needed to navigate both capital markets and the Insurance, reinsurance, pension, and banking businesses, was critical as he guided executives through everchanging landscapes. Luis has worked with the range of fintech and established, global, multi-trillion-dollar financial institutions to help them understand and successfully implement the tools needed across their investment, risk, balance sheet, and regulatory and financial reporting functions. As a trusted partner, Luis' consensus-based approach lends to solutions with appropriately balanced complexity, practicality and cost, achieving business acumen inherently unique to each of his clients.



Bill Poutsika, Senior Advisor. As a seasoned financial services executive, Bill has considerable accomplishments, including successful strategic and operational transformations, as CEO, CIO and board member for global insurance and asset management businesses. He is currently consulting, doing board work, research on application of emerging data science methods, advising fintech organizations and startups, publishing, and speaking at conferences and universities. Bill has served as an active director on the boards of public, mutual, private and non-profit organizations. These organizations have included global and highly specialized insurance and investment entities. His executive roles include Chief Investment Officer & SVP of AIG Property Casualty following the financial crisis; CEO of quantitative investment firm PanAgora Asset Management, and CEO Arkwright Mutual Insurance Co which he merged to form FM Global. Bill began his career in the investment department of the Liberty Mutual Insurance Co. He received a B.A. from Muhlenberg College and an M.B.A. from Boston College's Carroll School of Management where he was later the first recipient, and commencement speaker, of the Distinguished Achievement Award for managerial excellence and community service.