BEFORE THE
STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

In the Matter of

Veolia Water New York, Inc.

Case 23-W-0111

June 2023

Prepared Exhibits of
Staff Finance Panel:

Vincent S. Califano
Associate Utility Financial Analyst
Office of Accounting, Audits and Finance

Hasan Ahmed
Senior Utility Financial Analyst
Office of Accounting, Audits and Finance

State of New York
Department of Public Service
Three Empire State Plaza
Albany, New York 12223-1350

Case 23-W-0111

Staff Finance Panel
Index of Exhibits

Case 23-W-0111

Relied Upon Responses to Information Requests
Index of Exhibit__(FP-1)

STAFF OF THE DEPARTMENT OF PUBLIC SERVICE
Pre-Filing INTERROGATORY/DOCUMENT REQUEST
Veolia Water New York, Inc.

Request No.: Pre-Filing STAFF-4

Requested By: DPS Staff

Date of Request: Pre-Filing

Response Due: With Filing

Witness: Graziano

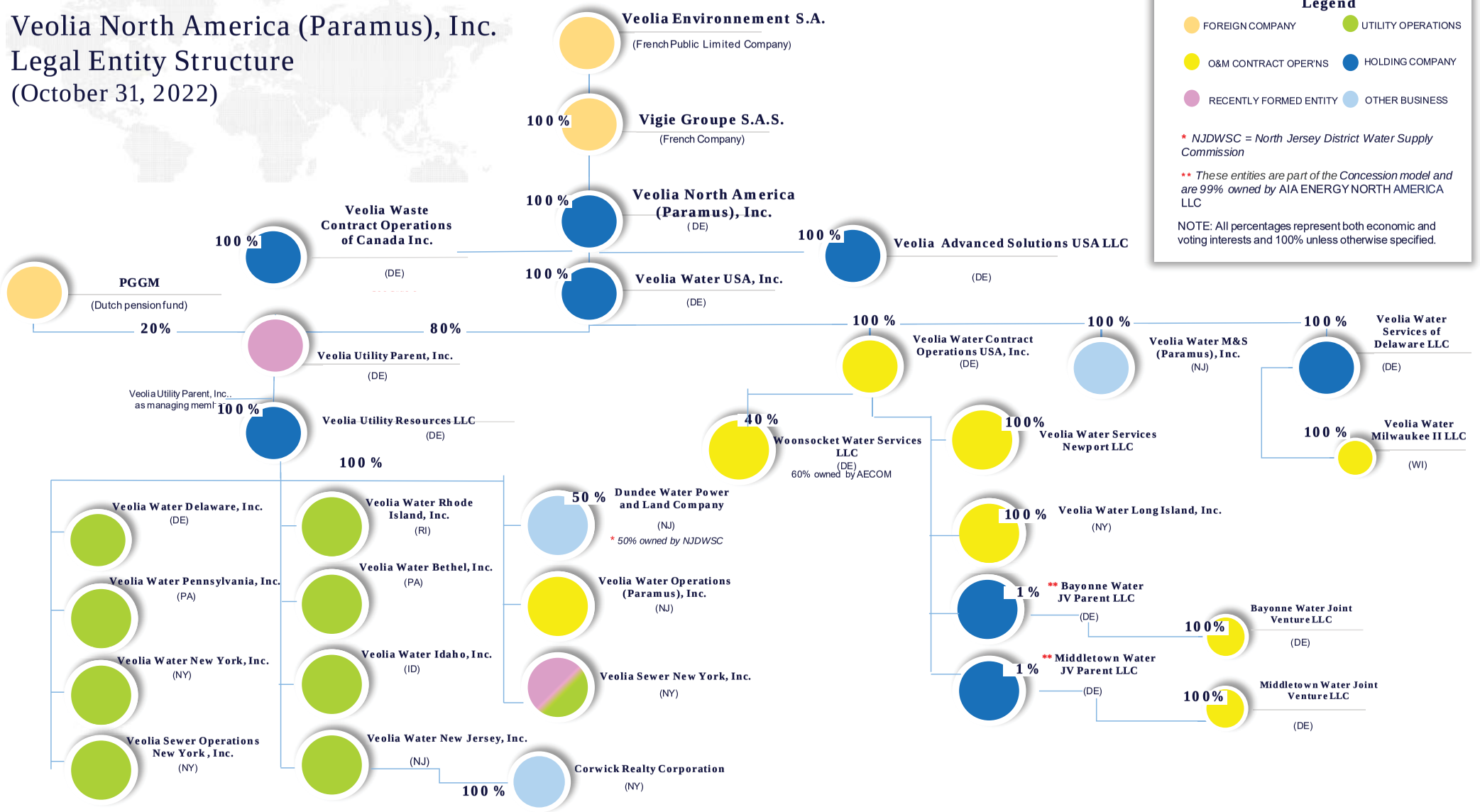
Subject: General

Provide a structural organization chart of the company, its affiliates, its subsidiaries, its parent or holding company and all parent or holding company affiliates. Provide a listing of current members of Boards of Directors and their occupations for each entity.

Response:

Please refer to Pre-Filing IR STAFF-4 Attachment A for the organization chart. Please refer to Pre-Filing IR STAFF-4 Attachment B for a listing of members of Boards of Directors.

Veolia North America (Paramus), Inc.
Legal Entity Structure
(October 31, 2022)



II. MUNICIPAL WATER – UTILITY

Corwick Realty Corporation

Domestic State: New York
Parent Company: Veolia Water New Jersey, Inc.

Directors	Officers
Rodolphe Bouichou	Karine Rougé, Chief Executive Officer
Karine Rougé	Rodolphe Bouichou, Chief Financial Officer - Utility Operations
	Michael Algranati, Vice President & Treasurer
	Whitney Fawcett, Assistant Secretary
	Martin Vosburg, Assistant Treasurer

[The] Dundee Water Power and Land Company

Domestic State: New Jersey
Parent Company: • 50% Veolia Utility Resources LLC
• 50% North Jersey District Water Supply Commission (NJDWSC)

Directors	Officers
Rodolphe Bouichou (eff. 2/1/2023)	Rodolphe Bouichou, President (eff. 2/1/2023)
Alan Weland	Alan Weland, Vice President
Charles Shotmeyer	Rafael Flores, Treasurer
Howard L. Burrel	Antonio Vicente, Secretary

Veolia Sewer New York, Inc.

Domestic State: New York
Parent Company: Veolia Utility Resources LLC

Directors
Rodolphe Bouichou
Karine Rougé

Officers
Karine Rougé, Chief Executive Officer
Rodolphe Bouichou, Chief Financial Officer - Utility Operations
Christopher Graziano, Vice President & General Manager
Michael Algranati, Vice President & Treasurer
Bryant Gonzalez, Corporate Counsel & Secretary (eff. 9/1/2022)
Whitney Fawcett, Assistant Secretary
Martin Vosburg, Assistant Treasurer

Limited Signing Authority
Gerardo Moreno, Director, Engineering Utility

Veolia Sewer Operations New York, Inc.

Domestic State: New York
Parent Company: Veolia Utility Resources LLC

Directors
Rodolphe Bouichou
Karine Rougé

Officers
Karine Rougé, Chief Executive Officer
Rodolphe Bouichou, Chief Financial Officer - Utility Operations
Christopher Graziano, Vice President & General Manager
Michael Algranati, Vice President & Treasurer
Bryant Gonzalez, Corporate Counsel & Secretary (eff. 9/1/2022)
Whitney Fawcett, Assistant Secretary
Martin Vosburg, Assistant Treasurer

Limited Signing Authority
Gerardo Moreno, Director, Engineering Utility

Veolia Utility Parent, Inc.

Domestic State: Delaware
Parent Company: • 80% Veolia Water USA, Inc.
• 20% PGGM

Directors
Karine Rougé
Denis Chesseron
Brian J. Clarke
4th Director - TBD
Dennis van Alphen (PGGM)

Officers
Karine Rougé, Chief Executive Officer
Rodolphe Bouichou, Chief Financial Officer – Utility Operations
Andrianne Payson, Executive Vice President, General Counsel & Secretary
Michael Algranati, Vice President & Treasurer
James Cagle, Vice President
Whitney Fawcett, Assistant Secretary
Martin Vosburg, Assistant Treasurer

Non-Voting Observers
Corine van Heijningen (PGGM)
Anthony Coscia (Veolia)

Veolia Water Bethel, Inc.

Domestic State: Pennsylvania
Parent Company: Veolia Utility Resources LLC

Directors
Rodolphe Bouichou
Karine Rougé

Officers
Karine Rougé, Chief Executive Officer
Rodolphe Bouichou, Chief Financial Officer - Utility Operations
Larry Finnicum, Vice President & General Manager
Michael Algranati, Vice President & Treasurer
Bryant Gonzalez, Corporate Counsel & Secretary
Whitney Fawcett, Assistant Secretary
Martin Vosburg, Assistant Treasurer

Limited Signing Authority
Mark Baker, Manager, Operations

Veolia Water Delaware, Inc.

Domestic State: Delaware
Parent Company: Veolia Utility Resources LLC

Directors	Officers
Rodolphe Bouichou	Karine Rougé, Chief Executive Officer
Karine Rougé	Rodolphe Bouichou, Chief Financial Officer - Utility Operations
	Larry Finnicum, Vice President & General Manager
	Michael Algranati, Vice President & Treasurer
	Bryant Gonzalez, Corporate Counsel & Secretary (eff. 9/1/2022)
	Whitney Fawcett, Assistant Secretary
	James Terranova, Assistant Secretary
	Martin Vosburg, Assistant Treasurer

Veolia Water Idaho, Inc.

Domestic State: Idaho
Parent Company: Veolia Utility Resources LLC

Directors	Officers
Rodolphe Bouichou	Karine Rougé, Chief Executive Officer
Karine Rougé	Rodolphe Bouichou, Chief Financial Officer - Utility Operations
	Marshall Thompson, Vice President & General Manager
	Michael Algranati, Vice President & Treasurer
	Bryant Gonzalez, Corporate Counsel & Secretary
	Jarmila Cary, Assistant Secretary
	Whitney Fawcett, Assistant Secretary
	James Terranova, Assistant Secretary
	Martin Vosburg, Assistant Treasurer

Limited Signing Authority
Catherine Cooper, Director, Engineering Utility

Veolia Water New Jersey, Inc.

Domestic State: New Jersey
Parent Company: Veolia Utility Resources LLC

Directors
Rodolphe Bouichou
Karine Rougé

Officers
Karine Rougé, Chief Executive Officer
Rodolphe Bouichou, Chief Financial Officer - Utility Operations
Alan Weland, Vice President & General Manager
Michael Algranati, Vice President & Treasurer
Bryant Gonzalez, Corporate Counsel & Secretary
James Terranova, Assistant Secretary
Whitney Fawcett, Assistant Secretary
Martin Vosburg, Assistant Treasurer

Limited Signing Authority
Jim Mastrokalos, Director, Operations
Antonio Vicente, Manager, Networks Engineering & New Business Engineering

Veolia Water New York, Inc.

Domestic State: New York
Parent Company: Veolia Utility Resources LLC

Directors
Rodolphe Bouichou
Karine Rougé

Officers
Karine Rougé, Chief Executive Officer
Rodolphe Bouichou, Chief Financial Officer - Utility Operations
Christopher Graziano, Vice President & General Manager
Michael Algranati, Vice President & Treasurer
Bryant Gonzalez, Corporate Counsel & Secretary (eff. 9/1/2022)
James Terranova, Assistant Secretary
Whitney Fawcett, Assistant Secretary
Martin Vosburg, Assistant Treasurer

Limited Signing Authority
Gerardo Moreno, Director, Engineering Utility

Veolia Water Operations (Paramus), Inc.

Domestic State: New Jersey
Parent Company: Veolia Utility Resources LLC

Directors	Officers
Rodolphe Bouichou	Karine Rougé, Chief Executive Officer
Karine Rougé	Rodolphe Bouichou, Chief Financial Officer - Utility Operations
	Michael Algranati, Vice President & Treasurer
	Bryant Gonzalez, Corporate Counsel & Secretary
	Whitney Fawcett, Assistant Secretary
	Martin Vosburg, Assistant Treasurer

Veolia Water Pennsylvania, Inc.

Domestic State: Pennsylvania
Parent Company: Veolia Utility Resources LLC

Directors	Officers
Rodolphe Bouichou	Karine Rougé, Chief Executive Officer
Karine Rougé	Rodolphe Bouichou, Chief Financial Officer - Utility Operations
	Larry Finnicum, Vice President & General Manager
	Michael Algranati, Vice President & Treasurer
	Bryant Gonzalez, Corporate Counsel & Secretary
	Whitney Fawcett, Assistant Secretary
	James Terranova, Assistant Secretary
	Martin Vosburg, Assistant Treasurer

Limited Signing Authority
Mark Baker, Manager, Operations

Veolia Utility Resources LLC

Domestic State: Delaware
Parent Company: Veolia Utility Parent, Inc.

Managers
Member Managed

Officers
Karine Rougé, Chief Executive Officer
Rodolphe Bouichou, Chief Financial Officer - Utility Operations
Michael Algranati, Vice President & Treasurer
James Cagle, Vice President
Bryant Gonzalez, Corporate Counsel & Secretary
Tara Buckley, Director, Supply Chain Management
Whitney Fawcett, Assistant Secretary
Martin Vosburg, Assistant Treasurer

Veolia Water Rhode Island, Inc.

Domestic State: Rhode Island
Parent Company: Veolia Utility Resources LLC

Directors
Rodolphe Bouichou
Karine Rougé

Officers
Karine Rougé, Chief Executive Officer
Rodolphe Bouichou, Chief Financial Officer - Utility Operations
Christopher Graziano, Vice President & General Manager
Michael Algranati, Vice President & Treasurer
Bryant Gonzalez, Corporate Counsel & Secretary (eff. 9/1/2022)
Whitney Fawcett, Assistant Secretary
James Terranova, Assistant Secretary
Martin Vosburg, Assistant Treasurer

Limited Signing Authority
Gerardo Moreno, Director, Engineering Utility

STAFF OF THE DEPARTMENT OF PUBLIC SERVICE

INTERROGATORY/DOCUMENT REQUEST
Veolia Water New York, Inc.

Request No.: DPS-227

Requested By: Staff of the Department of Public Service

Date of Request: April 27, 2023

Response Due: May 8, 2023

Witness: Revenue Requirement Panel

Subject: Regulated Operations of Parent Company

Question:

1. Provide the percentage of regulated utility operations of Veolia Utility Resources LLC (on a consolidated basis), as of December 31, 2022, and identify the names(s) of its utility regulating agency(s). Provide the response in both Adobe and Microsoft Excel format.

2. Provide the percentage of regulated utility operations of Veolia Environnement SA (on a consolidated basis), as of December 31, 2022, and identify the names(s) of the utility regulating agency. Provide the response in both Adobe and Microsoft Excel format.

Response:

1. Regulated utility operations of Veolia Utility Resources LLC comprise 99.27% of total revenues, 99.96% of Net Assets and 99.74% of total Payroll expense. Regulating agencies are listed below:
    - New Jersey – New Jersey Board of Public Utilities
    - Pennsylvania – Pennsylvania Public Utility Commission
    - Delaware – Delaware Public Service Commission
    - Idaho – Idaho Public Utilities Commission
    - Rhode Island – State of Rhode Island and Providence Plantations Public Utilities Commission.
    - New York – State of New York Public Service Commission

2. Regulated utility operations of Veolia Environnement S.A. is comprised of Veolia Utility Resources LLC. VUR comprises approximately 1.5% of total revenues, approximately 5.5% of net assets and 1.1% of total operating expenses. Regulating agencies are listed below:
    - New Jersey – New Jersey Board of Public Utilities
    - Pennsylvania – Pennsylvania Public Utility Commission
    - Delaware – Delaware Public Service Commission
    - Idaho – Idaho Public Utilities Commission
    - Rhode Island – State of Rhode Island and Providence Plantations Public Utilities Commission.
    - New York – State of New York Public Service Commission

   Please see the Veolia Environnement S.A. 2022 Annual Financial Report attached to DPS-229 and at https://www.veolia.com/sites/g/files/dvc4206/files/document/2023/04/VE_URD_2022_EN.pdf. Please note the Veolia Environnement S.A are kept in accordance with IFRS accounting and are presented in Euros. The above comparisons utilized a conversion factor of .9487 Euros per Dollar.

   Veolia Environnement S.A. is comprised of three business lines: Water, Waste and Energy. Further description can be found beginning on page 31 of the above referenced annual report.

STAFF OF THE DEPARTMENT OF PUBLIC SERVICE
INTERROGATORY/DOCUMENT REQUEST
Veolia Water New York, Inc.

Request No.: DPS-187

Requested By: Staff of the Department of Public Service

Date of Request: April 12, 2023

Response Due: April 24, 2023

Witness: James Cagle

Subject: Cost of Capital Matrix - Rate of Return Matrix

Question:

1. Provide Veolia Water New York, Inc.'s (Company) cost of capital matrix for the Historical Test Year (ending September 30, 2022). Include both the after-tax return of return (weighted cost rate) and pre-tax rate of return in Microsoft Excel format with all formulas intact and functions enabled.

2. Provide the Company's forecasted cost of capital matrix for Rate Year One (ending January 31, 2025), Rate Year Two (ending January 31, 2026), and Rate Year Three (ending January 31, 2027) based on the Company's 10.50% return on equity request. Include both the after-tax return of return (weighted cost rate) and pre-tax rate of return in Microsoft Excel format with all formulas intact and functions enabled.

3. The Company's financial statements as of September 30, 2022, indicate a total of $30,246 for customer deposits for the New York District, per Exhibit RRP-1, Schedule 1, page 1 of 7 (New York District) and a total of $1,761,508 for customer deposits for the Westchester District, per Exhibit RRP-1, Schedule 1, page 1 of 7 (Westchester District). Explain why Company Witness Walker did not include customer deposits in his proposed cost of capital matrix.

4. Provide the Company's cost of capital matrix for the Historical Test Year (Ending September 30, 2022) based on the Company's 10.50% return on equity request and including customer deposits. Include both the after-tax return of return (weighted cost rate) and pre-tax rate of return in

Microsoft Excel format with all formulas intact and functions enabled.

5. Provide the Company's forecasted cost of capital matrix for Rate Year One (ending January 31, 2025), Rate Year Two (ending January 31, 2026), and Rate Year Three (ending January 31, 2027) based on the Company's 10.50% return on equity request and including customer deposits. Include both the after-tax return of return (weighted cost rate) and pre-tax rate of return in Microsoft Excel format with all formulas intact and functions enabled.

6. Provide Veolia Utility Resources LLC's forecasted cost of capital matrix for Rate Year One (ending January 31, 2025), Rate Year Two (ending January 31, 2026), and Rate Year Three (ending January 31, 2027). Include both the after-tax return of return (weighted cost rate) and pre-tax rate of return in Microsoft Excel format with all formulas intact and functions enabled.

7. Provide Veolia Environment SA's forecasted cost of capital matrix for Rate Year One (ending January 31, 2025), Rate Year Two (ending January 31, 2026), and Rate Year Three (ending January 31, 2027). Include both the after-tax return of return (weighted cost rate) and pre-tax rate of return in Microsoft Excel format with all formulas intact and functions enabled.

Response:

1. Veolia Water New York, Inc. ("VWNY") is a wholly owned subsidiary of Veolia Utility Resources LLC and holds no debt. As a result, the balance sheet of VWNY includes all equity.

2. Please see the response to 1.

3. In its last rate case filing (19-W-0168), the Company included customer deposits as a reduction to rate base as opposed to including customer deposits as a portion of capital structure. This was included in the Joint Proposal and accepted by the Commission in its Order in that case. As a result, the Company included customer deposits as a reduction to rate base in this case also.

4. Please see the response to 1.

5. Please see the response to 1.

6. Please see DPS-187 Attachment. Note the information is provided for the calendar years.

7. Such forecasts are not available. Please also note the accounting information supporting the financial statements of Veolia S.A. are maintained in compliance with IFRS and are not comparable to VUR which are maintained under GAAP.

In addition, the Company would reference certain portions of the Veolia's corporate website www.Veolia.com which may be useful in Staff's analysis.

Veolia S.A. includes operations worldwide in three business lines,

Water (management of drinking water production and wastewater treatment plants),

https://www.veolia.com/en/veolia-group/profile/business-activities/water-management

Waste (solid waste collection and recycling, hazardous waste treatment, organic waste recovery and waste to energy), and

https://www.veolia.com/en/veolia-group/profile/business-activities/waste-management

Energy (heating and cooling network management and renewable energy production). Of these activities, only the subsidiaries of VUR are regulated utilities.

https://www.veolia.com/en/veolia-group/profile/business-activities/energy-management

Please also see the Veolia S.A. Universal Registration Document 2022 beginning on page 31 for more information regarding the business lines

https://www.veolia.com/sites/g/files/dvc4206/files/document/2023/04/VE_URD_2022_EN.pdf

Worldwide, Veolia S.A. employs approximately 220k employees, of which the entirety of its North American operations totals approximately 13,800 which represent approximately 6.5%. VUR (consolidated) employs approximately 1,100 or less than 1%.

Of Veolia's approximately $47B (converted from Euros) in revenues, Total VUR revenues is approximately $686M or about 1.5%.

Please also see the Revenue Requirements Panel Testimony regarding the ring fencing measure in place and the response to DPS-185.

Veolia Utility Resources LLC
Forecasted Capital Structure
and Estimated Rates of Return

For the 12 Months Ended	12/31/2024	12/31/2025	12/31/2026
Capital Structure %			
Long term debt	45.85%	45.77%	45.80%
Equity	54.15%	54.23%	54.20%
	100.0%	100.0%	100.0%
Rate			
Long term debt	4.44%	4.56%	4.69%
Equity	10.50%	10.50%	10.50%
Weighted			
Long term debt	2.04%	2.09%	2.15%
Equity	5.69%	5.69%	5.69%
Total	7.73%	7.78%	7.84%
Pre-Tax	9.91%	9.96%	10.02%
Composite Income Tax Rate	27.68%	27.68%	27.68%

Notes:

The Equity Rate utilized in the above calculation is the rate proposed in this case.

STAFF OF THE DEPARTMENT OF PUBLIC SERVICE
Pre-Filing INTERROGATORY/DOCUMENT REQUEST
Veolia Water New York, Inc.

Request No.: Pre-Filing STAFF-58

Requested By: DPS Staff

Date of Request: Pre-Filing

Response Due: With Filing

Witness: Walker

Subject: Rate of Return

Provide a list of all forecasted external financings expected from the end of the historic test year through the end of each rate year.

Response:

Please refer to the table below. All external debt is issued by Veolia Utility Resources LLC, parent company of Veolia Water New York, Inc. The projected current year budget + 2 years of financing is listed.

VUR Financing Plans	2023	2024	2025
Financing Needs	124,981,707	169,980,536	83,000,000
LT Debt Maturing	25,018,293	10,019,464	57,000,000
Total External Debt Issuances	150,000,000	180,000,000	140,000,000

STAFF OF THE DEPARTMENT OF PUBLIC SERVICE
INTERROGATORY/DOCUMENT REQUEST
Veolia Water New York, Inc.

Request No.: DPS-184

Requested By: Staff of the Department of Public Service

Date of Request: April 12, 2023

Response Due: April 24, 2023

Witness: Harold Walker

Subject: Cost of Debt - Follow up to Staff's pre-filed IR-54 and IR-58

Question:

1. Provide Veolia Water New York, Inc.'s (Company) cost of debt calculations in Microsoft Excel format with all formulas intact and functions enabled.

2. Provide a detailed schedule of the Company's forecasted external financings (total external debt issuances) expected from the end of the historic test year through the end of each rate year. Include the original principal amount, the amount outstanding, rate year interest, amortization of issuance expenses for each issuance, premiums and discounts, and interest rate calculation for individual issuance calculations. Provide this response in Microsoft Excel format with all formulas intact and functions enabled.

Response:

1. Please refer to DPS-184 Attachment.

2. Please refer to Pre-Filing IR Staff-58 Response showing forecasted external financing needs for 2023, 2024 and 2025. The Company does not project original principal amounts, interest, debt issuance costs, etc.

VEOLIA UTILITY RESOURCES LLC
Actual
COMPOSITE COST RATE OF DEBT

Line #	[1] Description of Debt	[2] Issue Date	[3] Maturity Date	[4] [a] Amount Outstanding	[5] Unamortized Net Discount, Premium and Expense	[6] Net Proceeds (C.4+/-C.5)	[7] Stated Interest Rate	[8] Annual Interest Expense (C.4xC.7)	[9] 12months Amortization of Net Discount Premium and Expense	[10] Annual Cost (C.8+C.9)	[11] Effective Cost Rate	[12] Weighted Embedded Cost Rate
1	Medium Term Note Series A 1998	Feb-98	Feb-23	0	0	0	0.00%	0	0	0	0.00%	0.00%
2	SWR SENIOR NOTES 2015 SERIES A	Aug-15	Aug-30	75,000,000	224,830	74,775,170	3.80%	2,850,000	29,977	2,879,977	3.85%	0.21%
3	SWR SENIOR NOTES 2015 SERIES B	Aug-15	Aug-31	75,000,000	238,882	74,761,118	3.60%	2,700,000	28,104	2,728,104	3.65%	0.20%
4	SWR SENIOR NOTES 2015 SERIES C	Aug-15	Aug-35	125,000,000	468,499	124,531,501	4.09%	5,112,500	37,480	5,149,980	4.14%	0.37%
5	Tax Exempt-Dauphin 92 TEF Series A	Jun-92	Jun-24	10,000,000	29,220	9,970,780	6.90%	690,000	18,480	708,480	7.11%	0.05%
6	Senior Note Series 2010	Jan-10	Jan-25	45,000,000	170,200	44,829,800	4.92%	2,214,000	88,800	2,302,800	5.14%	0.17%
7	Senior Note Series B	Nov-07	Nov-28	15,000,000	41,814	14,958,186	6.13%	919,500	7,272	926,772	6.20%	0.07%
8	Medium Term Note Mutual of Omaha A	Oct-08	Oct-29	7,500,000	16,274	7,483,726	6.54%	490,500	2,472	492,972	6.59%	0.04%
9	Medium Term Note Mutual of Omaha B	Dec-08	Dec-29	7,500,000	16,686	7,483,314	6.59%	494,250	2,472	496,722	6.64%	0.04%
10	Senior Note Series 2011	Dec-11	Dec-27	20,000,000	256,012	19,743,988	4.10%	820,000	52,968	872,968	4.42%	0.06%
11	Private Placement Note Series B	Apr-11	Apr-26	40,000,000	289,774	39,710,226	4.68%	1,872,000	93,971	1,965,971	4.95%	0.14%
12	Senior Note 2018 Series C	Jan-18	Jan-33	65,000,000	228,169	64,771,831	3.30%	2,145,000	23,009	2,168,009	3.35%	0.16%
13	Senior Note 2018 Series D	Jan-18	Jan-48	65,000,000	286,649	64,713,351	3.77%	2,450,500	11,504	2,462,004	3.80%	0.18%
14	Senior Note 2017 Series A	Dec-17	Dec-32	70,000,000	252,017	69,747,983	3.30%	2,310,000	25,629	2,335,629	3.35%	0.17%
15	Senior Note 2017 Series B	Dec-17	Dec-47	75,000,000	340,955	74,659,045	3.77%	2,827,500	13,730	2,841,230	3.81%	0.20%
16	Senior Notes Series A 2019	Nov-19	Nov-34	150,000,000	441,339	149,558,661	2.94%	4,410,000	38,218	4,448,218	2.97%	0.32%
17	Senior Notes Series B 2019	Nov-19	Nov-49	55,000,000	185,684	54,814,316	3.39%	1,864,500	6,765	1,871,265	3.41%	0.13%
18	Senior Notes Series D 2019	Nov-19	Nov-59	40,000,000	139,250	39,860,750	3.49%	1,396,000	3,658	1,399,658	3.51%	0.10%
19	Senior Notes Series C 2019	Feb-20	Feb-50	30,000,000	132,946	29,867,054	3.42%	1,026,000	5,168	1,031,168	3.45%	0.07%
20	North Jersey Water District	n/a	Jul-24	28,752	-	28,752	6.30%	1,811	-	1,811	6.30%	0.00%
21	Senior Note 2012 Series A	Oct-12	Oct-27	10,000,000	178,915	9,821,085	3.47%	347,000	39,019	386,019	3.93%	0.03%
22	Senior Note 2012 Series B	Oct-12	Oct-32	30,000,000	818,740	29,181,260	3.91%	1,173,000	85,425	1,258,425	4.31%	0.09%
23	Senior Note	Jan-95	Jan-25	12,000,000	24,118	11,975,882	8.98%	1,077,600	12,757	1,090,357	9.10%	0.08%
24	Senior Notes Series A 2021	Nov-21	Nov-51	55,000,000	211,635	54,788,365	3.04%	1,672,000	7,376	1,679,376	3.07%	0.12%
25	Senior Notes Series B 2021	Nov-21	Nov-61	120,000,000	475,972	119,524,028	3.14%	3,768,000	12,302	3,780,302	3.16%	0.27%
26	Senior Notes, Series A 2022	Nov-22	Nov-42	35,000,000	-	35,000,000	5.77%	2,019,500	-	2,019,500	5.77%	0.15%
27	Senior Notes, Series B 2022	Nov-22	Nov-52	135,000,000	-	135,000,000	5.86%	7,911,000	-	7,911,000	5.86%	0.57%
28	Senior Notes, Series C 2023	Jan-23	Jan-53	30,000,000	-	30,000,000	5.86%	1,758,000	-	1,758,000	5.86%	0.13%
29	Total Long-Term Debt			1,397,028,752	5,468,579	1,391,560,173		56,320,161	646,557	56,966,718		4.09%
30	Additional Debt Costs											
31	Committed Facility Associated costs				49,504				49,504	49,504	0.00%	0.00%
32	Moore & VanAllen legal fees & Chapman (pending amortization start)				552,754				-	-	0.00%	0.00%
33	Amount being researched				90,902				-	-	-	-
34	Reg Asset - Reclass				12,197,213				1,407,371	1,407,371	0.10%	0.10%
	Totals				18,358,952				2,103,431	58,423,592		4.20%

Veolia Water New York, Inc.
Rate of Return Required For:
Twelve Months Ending January 31, 2025

Staff's Rate of Return Matrix (Hypothetical Capital Structure)

	Average Capitalization %	Cost Rate %	After-Tax Cost Rate %	Pre-Tax Cost Rate %
Long Term Debt	56.00%	4.20%	2.35%	2.37%
Customer Deposits	0.00%	3.45%	0.00%	0.00%
Common Equity	44.00%	8.85%	3.89%	5.42%
Total Capitalization	100.00%		6.25%	7.79%

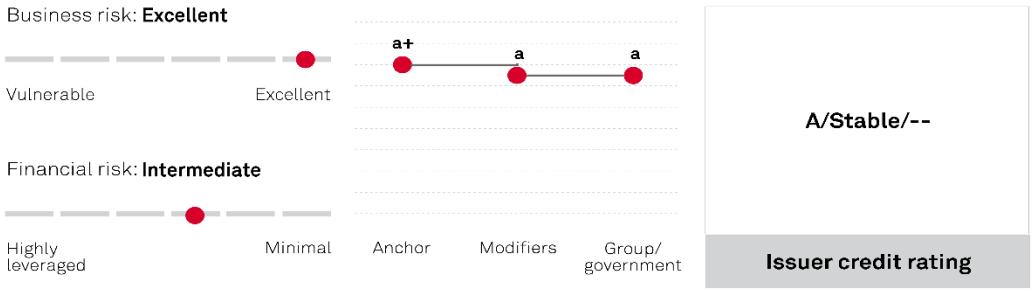
S&P Global
Ratings

RatingsDirect®

Veolia Utility Resources LLC

April 13, 2023

Ratings Score Snapshot



PRIMARY CONTACT

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david.de.juliis
@spglobal.com

SECONDARY CONTACT

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Credit Highlights

Overview

Key strengths	Key risks
Derives the vast majority of cash flows from low-risk, rate-regulated water and wastewater utility operations.	Negative forecast discretionary cash flow indicates external funding needs, which will likely entail additional leverage.
Benefits from geographic and regulatory diversity, given that it provides services to about 2.1 million customers across six states.	Inflationary trends and the higher interest rate environment could weigh on the company's credit quality.
Effective management of regulatory risk, as demonstrated by the implementation of numerous constructive regulatory mechanisms.	
Derives the majority of revenue from residential and other lower-risk sources, which are less cyclical than industrial and commercial sources.	

Veolia Utility Resources (VUR) continues to demonstrate effective regulatory risk management. The company files for periodic water rate cases, as needed, in its main operating regions--including New York, New Jersey, Pennsylvania, Delaware, Idaho, and Rhode Island--and is subject to regulation by the public utility commissions of each of these states with respect to its rate filings. Some of VUR's ongoing rate filings are in New York and Idaho, where it is seeking to either increase its annual water rates or recover costs associated with water system integrity and improvement projects. We will continually monitor developments related to these rate filings, as well as VUR's ability to reach constructive regulatory outcomes.

We expect VUR to remain an insulated subsidiary of Veolia Environnement S.A. (Veolia). A number of insulating measures between VUR and Veolia enable us to rate VUR up to three notches above our rating on Veolia.

We expect VUR to maintain funds from operations (FFO) to debt of between 13% and 15%. We consider this level of FFO coverage to be at the lower end of the range for the intermediate financial risk profile category. We assess the company under our low-volatility financial benchmark tables. Our base-case forecast reflects VUR's manageable annual dividends to its parent, capital spending of about $400 million per year, the continued use of existing regulatory mechanisms, negative discretionary cash flow, and the refinancing of all debt maturities.

Outlook

The stable outlook on VUR reflects our stable outlook on Veolia, as well as our view of VUR's low-risk, rate-regulated water and wastewater utility operations. Furthermore, the outlook reflects our expectation that the insulating measures between the companies will remain in place for the foreseeable future and continue to enable us to rate VUR higher than Veolia. We also expect that VUR will continue to reach constructive regulatory outcomes and avoid any substantial increase in its business risk. Our base-case forecast assumes VUR and VUPI maintain S&P Global Ratings-adjusted FFO to debt of about 13%-15% over the next few years.

Downside scenario

We could lower our ratings on VUR over the next 24 months if VUPI's stand-alone financial measures weaken such that we forecast its FFO to debt will fall consistently below 12%. We could also lower the rating if the current structural insulating measures between the companies are weakened or we downgrade Veolia.

Upside scenario

We could raise our ratings on VUR if we upgrade Veolia and VUPI's stand-alone financial measures improve, including FFO to debt of consistently greater than 16%.

Our Base-Case Scenario

Assumptions

- Periodic rate-case filings across its service areas;
- The continued use of existing regulatory mechanisms;
- Capital spending averaging about $400 million annually;
- Dividends consistent with the company's current capital structure;
- Negative discretionary cash flow; and
- Refinancing of all debt maturities.

Key metrics

Veolia Utility Resources LLC --Key Metrics*

	2022a	2023e	2024f

FFO to debt (%)	15.3	13.5-14.5	13.5-14.0
Debt to EBITDA (x)	5.0	5.0-5.5	5.0-5.5
FFO cash interest coverage (x)	5.0	4.5-5.0	4.5-5.0
CFO to debt (%)	18.4	13.5-14.5	13.5-14.5

*All figures adjusted by S&P Global Ratings. a--Actual. e--Estimate. f--Forecast. FFO--Funds from operations. CFO--Cash flow from operations.

Company Description

Through its wholly owned subsidiaries, **VUR** provides regulated water and wastewater utility services to approximately 2.1 million customers in New York, New Jersey, Pennsylvania, Delaware, Idaho, and Rhode Island. About 1.2 million of the company's customers are in New York and New Jersey. VUR was formerly known as SUEZ Water Resources LLC and changed its name to Veolia Utility Resources LLC in March 2022 after Veolia acquired Suez S.A. VUR was founded in 1869 and is based in Paramus, New Jersey.

Business Risk

Our assessment of VUR's business risk profile is based on its lower-risk, rate-regulated water and wastewater utility businesses that serve a relatively large customer base spread across six states. We view the company's management of regulatory risk as above average, which partially reflects its extensive use of constructive regulatory mechanisms, including the distribution system improvement charge (DSIC) riders, a revenue decoupling mechanism, and multiyear rate plans in certain jurisdictions. Under our base-case scenario, we assume the company will continue to effectively manage its regulatory risk due, in part, to the frequency of its rate case filings across its jurisdictions. We also assume it will continue to use cost-recovery riders that we collectively view as favorable for its credit quality.

Financial Risk

We assess VUR's financial risk profile using our low-volatility financial benchmark table, which reflects its lower-risk, regulated utility businesses and effective management of regulatory risk. Under our base-case scenario, which assumes capital spending averaging about $400 million annually through 2025, dividend payments to its owners commensurate with the company's capital structure, continued rate-case filings, and the further use of the DSIC, we expect VUR's FFO to debt to be in the 13%-15% range (consistent with the lower end of the range for the intermediate financial risk profile category). This warrants our use of a negative comparable ratings analysis modifier, which results in a one-notch downward adjustment to our stand-alone credit profile (SACP) on the company4

Debt maturities

- 2023: $25 million;
- 2024: $10 million;
- 2025: $57 million; and
- 2026: $40 million.

Liquidity

We assess VUR's liquidity as adequate and expect its sources to be by 1.1x its uses over the next 12 months. In addition, we anticipate its net sources would remain positive even if its forecast consolidated EBITDA declines 10%. We believe the company's predictable regulatory framework provides manageable cash flow stability, even in times of economic stress, which supports our use

of slightly lower thresholds to assess its liquidity. In addition, we believe VUR could absorb high-impact, low-probability events, reflecting its about $250 million of committed credit facilities through 2026 and our belief it can maintain its high capital spending (averaging about $400 million annually through 2025) during stressful periods. This indicated it would have a limited need for refinancing under such conditions. Furthermore, our assessment reflects VUR's generally prudent risk management and sound relationships with its banking group. Overall, we believe that the company would likely be able to withstand adverse market circumstances over the next 12 months with sufficient liquidity to meet its obligations. The company's next long-term debt maturity is in 2023, when about $25 million comes due. We expect the company to proactively address this maturity well in advance of its scheduled due date.

Principal liquidity sources

- Committed credit facility availability of about $30 million;
- Assumed cash FFO of about $260 million; and
- Cash of about $1.4 million.

Principal liquidity uses

- Debt maturities of about $25 million; and
- Assumed maintenance capital spending of about $200 million.

Environmental, Social, And Governance

ESG Credit Indicators

E-1	**E-2**	E-3	E-4	E-5	S-1	**S-2**	S-3	S-4	S-5	G-1	**G-2**	G-3	G-4	G-5

ESG credit indicators provide additional disclosure and transparency at the entity level and reflect S&P Global Ratings' opinion of the influence that environmental, social, and governance factors have on our credit rating analysis. They are not a sustainability rating or an S&P Global Ratings ESG Evaluation. The extent of the influence of these factors is reflected on an alphanumerical 1-5 scale where 1 = positive, 2 = neutral, 3 = moderately negative, 4 = negative, and 5 = very negative. For more information, see our commentary "ESG Credit Indicator Definitions And Applications," published Oct. 13, 2021.

ESG factors have no material influence on our credit rating analysis of VUR.

Group Influence

We view Veolia as the ultimate parent in the group hierarchy. We view VUR as a strategically important subsidiary of Veolia, largely because it is unlikely to be sold, is important to the company's long-term strategy, and has a long-term commitment from senior management. VUR is reasonably successful relative to the group's overall earnings and is an important part of Veolia's regulated utility business because it successfully contributes to the profitability of Veolia's international business segment. Along with being successful at what it does, VUR is closely linked to the parent's name and reputation and has a long operating record of more than 100 years.

There are a number of insulating measures in place between VUR and its parent, Veolia, that allow us to rate VUR up to three notches above our 'BBB' issuer credit rating on Veolia. These measures include:

- VUR's intermediate holding company, VUPI, is a separate legal entity with its own capital structure, maintains its own records, does not commingle funds, assets, or cash flows, and does not participate in a money pool with parent Veolia;
- VUR also has its own credit facility and debt arrangements and has operations that are separate from the rest of the group;
- There is a strong economic basis for Veolia to preserve the credit strength of VUR, which reflects its low-risk, profitable, and regulated operations;
- VUPI is 20% owned by Dutch pension company PGGM and 80% owned by Veolia. PGGM is a significant minority shareholder of VUPI and has an active economic interest with board member representation;
- The governance rights in place for PGGM surrounding matters such as dividend distributions and voluntary bankruptcy filings support our view that there are independent directors who have effective influence on decision-making;

- Anti-dilutive measures are in place to ensure that PGGM can maintain its economic interest at current levels; and
- There are no cross-default provisions between Veolia and VUPI (or its subsidiaries) and the minority shareholder's governance rights supports our opinion that a default at Veolia would not directly lead to a default at VUR or its subsidiaries.

Issue Ratings--Subordination Risk Analysis

Capital structure

- VUR's capital structure includes about $1.5 billion of consolidated senior unsecured debt, almost all of which is at VUR.

Analytical conclusions

- We rate VUR's senior unsecured debt 'A', in line with our issuer credit rating on the company, due to the lack of material priority debt in its capital structure.

Rating Component Scores

Foreign currency issuer credit rating	**A/Stable/--**
Local currency issuer credit rating	**A/Stable/--**
Business risk	**Excellent**
Country risk	Very Low
Industry risk	Very Low
Competitive position	Excellent
Financial risk	**Intermediate**
Cash flow/leverage	Intermediate
Anchor	**a+**
Diversification/portfolio effect	Neutral (no impact)
Capital structure	Neutral (no impact)
Financial policy	Neutral (no impact)
Liquidity	Adequate (no impact)
Management and governance	Satisfactory (no impact)
Comparable rating analysis	Negative (-1 notch)
Stand-alone credit profile	**a**

Related Criteria

- General Criteria: Environmental, Social, And Governance Principles In Credit Ratings, Oct. 10, 2021
- General Criteria: Group Rating Methodology, July 1, 2019
- Criteria | Corporates | General: Corporate Methodology: Ratios And Adjustments, April 1, 2019
- Criteria | Corporates | General: Reflecting Subordination Risk In Corporate Issue Ratings, March 28, 2018
- General Criteria: Methodology For Linking Long-Term And Short-Term Ratings, April 7, 2017
- Criteria | Corporates | General: Methodology And Assumptions: Liquidity Descriptors For Global Corporate Issuers, Dec. 16, 2014
- General Criteria: Methodology: Industry Risk, Nov. 19, 2013

- General Criteria: Country Risk Assessment Methodology And Assumptions, Nov. 19, 2013
- Criteria | Corporates | General: Corporate Methodology, Nov. 19, 2013
- Criteria | Corporates | Utilities: Key Credit Factors For The Regulated Utilities Industry, Nov. 19, 2013
- General Criteria: Methodology: Management And Governance Credit Factors For Corporate Entities, Nov. 13, 2012
- General Criteria: Principles Of Credit Ratings, Feb. 16, 2011

Ratings Detail (as of April 13, 2023)*

Veolia Utility Resources LLC

Issuer Credit Rating	A/Stable/--

Issuer Credit Ratings History

05-May-2022	A/Stable/--
16-Apr-2021	A/Negative/--
26-Jan-2021	A/Watch Neg/--
05-Sep-2019	A/Stable/--

*Unless otherwise noted, all ratings in this report are global scale ratings. S&P Global Ratings credit ratings on the global scale are comparable across countries. S&P Global Ratings credit ratings on a national scale are relative to obligors or obligations within that specific country. Issue and debt ratings could include debt guaranteed by another entity, and rated debt that an entity guarantees.

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US Regulated Electric and Gas Utilities

High Leverage at the Parent Often Hurts the Whole Family

US utilities use leverage at the holding-company level to invest in other businesses, make acquisitions and earn higher returns on equity. In some cases, an increase in leverage at the parent can hurt the credit profiles of its regulated subsidiaries.

» **High leverage at the parent can have negative implications for the whole family.** The larger the parent's unregulated businesses are and the larger its holding-company debt is as a share of consolidated debt, the greater the likelihood that credit quality in the family will suffer. Increased leverage at the holding company often leads to a more than one-notch rating difference between the holding company and the operating company.

» **When a parent exits a large unregulated business, holding-company debt sometimes remains.** There are instances, such as CMS Energy Corp. (CMS, Baa2 stable) and TECO Energy Inc. (TECO, Baa1 stable), in which holding company debt once used to finance unregulated businesses remains even after the parent has exited the business, placing additional stress on the credit profiles of regulated utilities within the family. The regulated utility finds itself not only responsible for servicing its own debt but also for supporting the parent's debt.

» **"Double leverage" drives returns for some utilities but could pose risks down the road.** The use of double leverage, a long-standing practice whereby a holding company takes on debt and downstreams the proceeds to an operating subsidiary as equity, could pose risks down the road if regulators were to ascribe the debt at the parent level to the subsidiaries or adjust the authorized return on capital.

» **Regulators could take steps to mitigate contagion risks within the family.** Ring-fencing techniques can go a long way toward insulating the regulated utility, as in the case of Oncor Electric Delivery Company LLC (Baa1 senior secured rating, positive). But complete protection from an insolvent parent is not guaranteed. Also, regulators could attempt to influence changes in the capital structure or could adjust a utility's allowed rate of return because of the parent's use of double leverage, although we have not seen this in practice.

All in the Family

Unlike most US corporates in unregulated industries, US regulated electric and gas utilities typically have substantial barriers to the free movement of cash among members of the corporate family, and they issue material debt at their operating companies and at the holding-company level. As a result, we generally observe a meaningful difference in the credit profiles of US utility operating companies and their holding companies, a view that is often reflected in a difference in their respective ratings of one or more notches.

The most pervasive driver has been structural subordination of debt at the holding company. The operating company services its debt with cash flow from its operations, whereas the holding company depends on dividends from subsidiaries to service its debt obligations, which can be less certain. For US utilities, the greatest drivers of rating differentials of more than one notch have been the degree of leverage at the parent and/or investments in unregulated businesses with higher operating risk.

In our analysis of US utilities, we have also found that leverage at the parent has often had negative implications for the parent itself (with greater implications when the percentage of consolidated debt at the holding company was higher), and that very high leverage at the parent has affected the credit quality of the whole family. While an increase in leverage at the holding company does not increase structural subordination per se, it can exacerbate the impact of any structural subordination that exists. For instance, approximately 3% of the consolidated debt of Pinnacle West Capital Corp. (Baa1 positive) is at the parent, and there is a one-notch difference between its issuer rating and the issuer rating of its primary subsidiary, Arizona Public Service Company (A3 positive). By contrast, there is a two-notch difference between the issuer ratings of Duke Energy Corp. (A3 stable) and its two largest utility subsidiaries, partly because debt at the parent is 30% of the consolidated total.

We have also observed that unregulated businesses have added volatility to the cash flows of US utility holding companies. We do not view all unregulated businesses equally, since some are riskier than others, but volatility has generally been proportionate to the size of those businesses and the market risk to which they are exposed. For instance, there is a three-notch difference between the senior unsecured rating of Public Service Enterprise Group Inc. ((P)Baa2 stable), which has essentially no debt at the parent level but obtains about 40% of its cash flows from its unregulated power subsidiary (PSEG Power LLC , Baa1 stable), and the issuer rating of its utility subsidiary, Public Service Electric and Gas Company (A2 stable).

Furthermore, in some cases, depending on the amount of holding-company debt or the riskiness and scope of the unregulated businesses, the rating of the regulated utility has been constrained. An example of this is Dayton Power & Light Company (DP&L, Baa3 stable), a regulated utility whose rating is currently constrained by its highly leveraged parent, DPL Inc. (Ba3 stable), and to a lesser extent, its unregulated retail energy marketing affiliate.

Exhibit 1

Examples of Holding Companies Whose Debt and Unregulated Businesses Drive Wider Notching Differences

Holding Company	Unsecured / Issuer Rating	Primary Utility Subsidiaries	Unsecured / Issuer Rating	Notching Difference in Ratings	HoldCo Debt (% of Consolidated Debt)	Unregulated Business (% of Consolidated Earnings/Cash Flow)
Dominion Resources Inc.	Baa2	Virginia Electric and Power Company / Dominion Gas Holdings, LLC	A2	3	47%	20%
NextEra Energy, Inc.	Baa1	Florida Power & Light Company	A1	3	40%	50%
Sempra Energy	Baa1	Southern California Gas Company / San Diego Electric & Gas Company	A1	3	37%	16%
Public Service Enterprise Group Incorporated	(P)Baa2	Public Service Electric and Gas Company	A2	3	0%	40%
Otter Tail Corp	Baa2	Otter Tail Power Company	A3	2	11%	24%
OGE Energy Corp.	A3	Oklahoma Gas & Electric Company	A1	2	7%	25%
Entergy Corporation	Baa3	Entergy Louisiana, LLC / Entergy Arkansas, Inc.	Baa1 / Baa2	1 / 2	20%	24%

Source: Moody's Investors Service

Since DP&L is the main source of cash flow to service DPL's high level of debt, in our credit analysis we have considered this debt part of DP&L's capital structure from a debt-servicing standpoint.

For a discussion of our approach to ratings within a utility family, please see Appendix D of our Regulated Electric and Gas Utility Methodology , published December 2013.

Industry Consolidation Is a Key Driver of Holding-Company Debt

One of the main reasons for significant holding-company debt is merger and acquisition activity. DPL Inc. is one example. Its ultimate parent, The AES Corporation (Ba3 stable) acquired the regulated utility, DP&L, and financed it largely by placing an additional $1.25 billion of debt at DPL Inc.

A more recent example is The Laclede Group 's (Baa2 stable) 2014 acquisition of Alabama Gas Corp. (Alagasco, A2 stable). An increase in debt of $625 million at the parent level to finance the acquisition of Alagasco led us to downgrade Laclede Group's senior unsecured rating to Baa2 from Baa1. Laclede Group's holding-company debt increased to approximately 37% of total consolidated debt from less than 3%. Not only did the increase in debt drive the rating change at Laclede Group, but the significant holding-company leverage currently constrains Alagasco's A2 senior unsecured rating. Otherwise, Alagasco's rating could be higher given the utility's strong financial metrics and low risk business model operating in a credit-supportive Alabama regulatory jurisdiction.

The Last Man Standing

When a parent exits an unregulated business, some of the debt associated with the business remains at the holding company and can hurt the credit profiles of the remaining regulated subsidiaries. Some utility holding companies have sizable amounts of debt originally used to finance unregulated businesses that the parent exited, adding stress to the regulated utility's credit profile.

In this case, the regulated utility ends up responsible not only for servicing its own debt but also for supporting the legacy debt at the parent. Depending on the amount of legacy holding-company debt that remains, the de-leveraging effort can be a multiyear endeavor and, in some cases, requires the parent to reduce its dividend to maintain financial flexibility across the company.

One example is CMS Energy Corp. (CMS, Baa2 stable), parent of Consumers Energy Company (Consumers, A1 senior secured rating, stable), a regulated electric and gas utility in Michigan. About $3.4 billion, or 34%, of its consolidated debt is at the parent. Much of

Energy Future Holdings Corp.: Too Much Holding-Company Debt Gone Wrong

Amid Energy Future Holdings Corp.'s (EFH, not rated) downward spiral, which culminated in bankruptcy in April 2014, we downgraded the senior secured rating of its indirectly owned regulated electric transmission and distribution utility, Oncor Electric Delivery Company LLC, to Baa3 in February 2013. We downgraded Oncor to one notch above speculative grade for several reasons: the highly leveraged capital structure at Energy Future Intermediate Holding Company LLC (EFIH, not rated), Oncor's indirect parent; EFIH's high reliance on dividends from Oncor to support debt service; and EFH's high reliance on Oncor's upstream tax payments to support debt service, along with the interwoven cash-transfer relationship between EFH and EFIH.

At the same time, Oncor's senior secured rating did not fall below investment grade given the strong insulation from the existing ring-fence-type arrangements. Rather, Oncor's lower rating reflected EFIH's heavy and permanent reliance on Oncor. We did not expect the ring-fencing mechanisms to fail, and we expected that Oncor would not be materially affected by the contagion risk of a default and restructuring at its affiliates or parent holding companies. Oncor's rating also reflected its strong fundamentals, including the stability and predictability of its revenue and cash flow as well as the supportive regulatory environment in Texas.

Since EFH's bankruptcy filing, we have upgraded Oncor's senior secured rating to Baa1, which reflects both the stability and predictability of Oncor's low risk rate-regulated business and the credit protection provided by the uncontested ring-fencing provisions. We expect the oversight from the Public Utility Commission of Texas will continue to substantially shield Oncor from any uncertainties associated with its parent holding companies.

this debt was used to finance its previous unregulated businesses, most of which CMS exited several years ago. Today, only about 5% of CMS's cash flows come from its remaining unregulated businesses. Given that the remaining unregulated businesses contribute modestly to consolidated results, the onerous amount of parent debt falls on the shoulders of Consumers. As such, the holding-company debt has constrained the rating of Consumers, given CMS's lack of material cash-flow diversification. The dividend upstream from Consumers is essential to servicing its parent's debt, which, in turn, limits the utility's ability to respond to unforeseen events, a credit negative.

Entergy Corporation (Baa3 stable) is another example of a utility holding company whose credit profile is currently constrained by the substantial amount of debt at the parent. This debt is largely tied to Entergy Corp.'s highly volatile and shrinking unregulated nuclear business, Entergy Wholesale Commodities (EWC, not rated). EWC's aging, small and concentrated portfolio, which operates mostly in the Northeast, has inherently high operating costs, is exposed to event risk and faces persistent local opposition and increasing regulatory mandates. As such, EWC's volatile earnings and cash flow are driven by a market of low power prices and rising operating costs. A significant amount of debt is associated with EWC (about $2.8 billion of the total $14 billion in consolidated reported debt) and resides at the parent holding company. In a stand-alone credit assessment, we have assessed EWC as below investment grade, which weighs on Entergy Corp.'s Baa3 rating. However, Entergy Corp.'s financial metrics are strong for its rating category and are enhanced by diverse and stable cash flows from its multi-state regulated utilities.

Exhibit 2

Examples of Holding Companies Whose Debt Is the Main Driver of Notching Differentials

Holding Company	Unsecured / Issuer Rating	Primary Utility Subsidiaries	Unsecured / Issuer Rating	Notching Difference in Ratings	HoldCo Debt (% of Consolidated Debt)	Unregulated Business (% of Consolidated Earnings/Cash Flow)
DPL Inc. *	Ba3	Dayton Power & Light Company	Baa3	3	60%	<10%
Duquesne Light Holdings, Inc.	Baa3	Duquesne Light Company	A3	3	48%	<10%
The Laclede Group	Baa2	Alabama Gas Corporation / Laclede Gas Company	A2 / (P)A3	2 / 3	37%	5%
ITC Holdings Corp.	Baa2	All four transcos (e.g. ITC Midwest LLC)	A3	2	55%	0%
IPALCO Enterprises, Inc.	Baa3	Indianapolis Power & Light Company	Baa1	2	35%	0%
CMS Energy Corp	Baa2	Consumers Energy Company	A3**	2	34%	5%
Integrys Energy Group,, Inc.	A3	Wisconsin Public Service Corporation	A1	2	31%	<5%
Puget Energy Inc.	Baa3	Puget Sound Energy, Inc.	Baa1	2	31%	0%
Duke Energy Corporation	A3	Duke Energy Carolinas, LLC / Duke Energy Progress, Inc.	A1	2	30%	15%
TECO Energy Inc.	Baa1	Tampa Electric Power Company	A2	2	29%	<5%

* The ultimate parent of DPL Inc. and Dayton Power & Light Company is The AES Corp. (Ba3 stable). ** Consumers Energy Company does not have a senior unsecured rating but a first-mortgage bond senior secured rating of A1. Therefore, its implied senior unsecured rating is A3.

Source: Moody's Investors Service

Double Leverage Helps Drive Returns for Some Utilities but Adds Stress on the Family's Credit Profile

Double leverage, whereby the holding company takes on debt and downstreams the proceeds to its operating subsidiary, is a long-standing practice in the industry. If down the road regulators decide to revisit this corporate financial strategy by imputing holding-company debt to subsidiaries, it could hurt credit quality across an issuer's family. The principal reason is that US regulators generally set rates based on an actual capital structure at the utility and provide a higher return to the equity capital component.

Many of the utility holding companies we rate use double leverage in one form or another. ITC Holdings Corp. (ITC, Baa2 stable) is a holding company of electric transmission regulated operating subsidiaries: International Transmission Company , Michigan Electric

Transmission Company LLC , ITC Midwest LLC and ITC Great Plains LLC . Each subsidiary has a senior unsecured rating of A3, two notches higher than ITC's rating. ITC has historically issued debt at the parent level to finance acquisitions and equity infusions for its transmission subsidiaries. As a result, ITC Holdings' adjusted debt-to-capitalization ratio was about 64% at year-end 2014, while its subsidiaries' ratios were between 20%-40%.

Double Leverage Defined

Double leverage is a financial strategy whereby the parent raises debt but downstreams the proceeds to its operating subsidiary, likely in the form of an equity investment. Therefore, the subsidiary's operations are financed by debt raised at the subsidiary level and by debt financed at the holding-company level. In this way, the subsidiary's equity is leveraged twice, once with the subsidiary debt and once with the holding-company debt. In a simple operating-company / holding-company structure, this practice results in a consolidated debt-to-capitalization ratio that is higher at the parent than at the subsidiary because of the additional debt at the parent.

ITC's parent debt represents approximately 55% of ITC Holdings' total consolidated debt, and our analysis of ITC focuses on the vantage point of the consolidated parent. The substantial amount of holding-company debt in the capital structure drives the two-notch rating differential between ITC and its operating subsidiaries. We note that among US utilities, FERC-regulated transmission operating companies have among the lowest business risk and are sometimes permitted higher amounts of equity in their capital structure than other utilities.

Local natural-gas distribution companies (LDCs) have typically used debt at the parent to infuse equity down to their regulated LDC operating subsidiaries in order to finance capital investments. Two examples are Vectren Corporation (Vectren, not rated) and AGL Resources Inc. (AGL, not rated), which both have large LDC footprints in multiple states as well as other non-utility businesses. Most of the proceeds from Vectren's intermediate holding company, Vectren Utility Holdings Inc. (A2 stable), and AGL's holding-company debt are used to finance safety and reliability pipeline replacement programs at each of their LDCs, which generally receive timely rate recovery through adjustment mechanisms allowed by regulators.

Regulators Could Take Steps to Mitigate Contagion Risks

Ring-fencing techniques can go a long way toward insulating a regulated utility, as in the case of Oncor (please see the blue box on page 3). But complete protection from an insolvent parent is not guaranteed. Ring-fencing provisions have been used for some time, at least dating back to the 1990s, when Enron acquired Portland General Electric Company (PGE, A3 stable). The Oregon Public Utility Commission implemented ring-fencing requirements to help ensure that PGE was insulated from Enron's other unregulated operations that eventually led to Enron's bankruptcy. Among these conditions was a requirement to maintain a minimum of 48% equity in the utility's capital structure as well as a requirement that the utility give regulators advance notice of any large dividend payment from the utility to the parent. While PGE's rating was downgraded several notches subsequent to the Enron bankruptcy, the existence of ring-fencing protections helped preserve PGE's investment-grade rating throughout the Enron bankruptcy.

Ring-fencing protections will continue to be considered by regulators, especially when involving M&A activity or when the state regulator becomes concerned about the potential contagion effect on the utility from the parent's unregulated operations or more debt.

Separately, regulators could attempt to influence changes in the capital structure or could adjust a utility's allowed rate of return because of the parent's use of double leverage. However, we have not seen evidence of this in practice. Given the widespread and long-standing use of double leverage across the industry, we do not expect that regulators will attempt to dissuade the use of this financial strategy unless regulators see it harming the utility.

Regulators could also offset the risk of additional holding-company leverage with future benefits to ratepayers by recognizing some or all parent level debt when setting rates. This, too, is uncommon and unlikely, since regulators' purview is typically focused on the

regulated entity and not the parent's capital structure. In addition, it could be difficult to allocate holding-company debt given the complexity of some organizational structures that operate in multi-state jurisdictions and that have unregulated businesses.

Rising Interest Rates Will Increase the Burden on the Family

Rising interest rates will increase refinancing costs at the parent level. Unlike a regulated utility, a holding company can not typically recover rising costs through customer rate increases. A higher interest expense at a leveraged parent that has no other sources of cash flow will further increase the burden on its regulated utility.

Moody's Related Research

Special Comments

» Lower Authorized Equity Returns Will Not Hurt Near-Term Credit Profiles, March 2015 (1003101)

» Adequate regulatory returns and timely cost recovery drive stable outlook…, November 2014 (177389)

» Wider Rating Differentials Seen for a Number of U.S. Utility and Parent Companies, October 2011 (136354)

» Proposed Wider Notching Between Certain Senior Secured Debt Ratings and Senior Unsecured Debt Ratings for Investment Grade Regulated Utilities, May 2009 (116748)

Outlooks

» 2015 Outlook - US Regulated Utilities: Regulatory Support Drives Our Stable Outlook, December 2014 (1000683)

» 2015 Outlook - US Unregulated Power: Stable Gas Prices, Declining Reserve Margins Underpin Our Stable Outlook, December 2014 (1000699)

Rating Methodologies

» Regulated Electric and Gas Networks Rating Methodology, November 2014 (159570)

» Unregulated Utilities and Unregulated Power Companies, November 2014 (172784)

» Moody's Regulated Electric and Gas Utilities Methodology, December 2013 (157160)

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Electric and Gas – North America

Utility holding companies rated Baa exhibit distinct strengths and weaknesses

Some holding companies have lowered their business risk profiles in recent years. The vast majority of North American investor-owned utility holding companies are rated Baa, although there is notable variation in key areas of importance to credit quality, including business risk, regulatory supportiveness, financial profile, holding company debt, diversity and exposure to ESG risks. Since our previous report on Baa-rated utility holding companies was published in 2018, some companies have taken steps to reduce risk.

Most of the holdco's utilities operate in credit supportive regulatory jurisdictions. Regulation remains the overarching credit consideration for holdcos and their utility subsidiaries and most continue to benefit from credit supportive regulation.

Financial metrics for most companies are similar. The financial profiles of most Baa-rated utility holdcos, as represented by a ratio of cash flow from operations before working capital changes (CFO pre-W/C) to debt between 14% and 16%, are similar, although there are both strong and weak outliers. Most notably, those holding companies with financial metrics close to their thresholds for a possible downgrade have the least financial cushion.

Parent debt remains high. Nearly half of the 41 holding companies within the peer group have parent-level debt that accounts for at least 25% of consolidated debt, which pressures credit quality. Holding companies with elevated parent debt can find it more difficult to pay down debt and improve their overall consolidated metrics, especially if their operating utilities also have weak financial profiles.

Diverse regulation mitigates risk and supports credit quality. Geographic diversity may mitigate exposure to unsupportive regulatory outcomes, severe weather events and local economic pressures, while reducing the credit impact that individual subsidiaries can have on the holding company. Diversifying into unregulated businesses, a strategy less common today than in years past, may also increase risk.

Credit impact scores indicate that ESG attributes have a limited impact on ratings. Environmental, social and governance issues have an overall moderately negative credit impact on most regulated electric and gas utility holding companies, as indicated by the median credit impact score of CIS-3. The group's positioning for carbon transition is already strong and is likely to improve further as utilities accelerate retirement of coal-fired generation.

Some holding companies have lowered business risk, a few have increased it

The vast majority of North American investor-owned utility holding companies (holdcos) are rated Baa, although there is significant variation in key areas that we consider important to credit quality: business risk, regulatory supportiveness, financial profile, holding company debt, diversity and exposure to ESG considerations. In this report, we provide our assessment of each company's relative ranking in terms of these seven key credit drivers, describe sector developments since we published our previous report on Baa-rated utility holding companies in 2018 and discuss those companies that have notably improved or declined in their relative positioning over the last few years. We broadened the group of companies in the report to include sizable intermediate holding companies and utility operating companies that do not have holding companies.

The higher the proportion of cash flow that a utility holding company generates from its regulated utility operations, the lower its business risk. Low business risk in the sector usually reflects the stability and predictability generally conferred by regulation, which typically sets prices and limits competition. Holdcos whose subsidiaries consist largely of electric transmission and distribution (T&D) utilities typically have the lowest business risk. While holding companies of natural gas local distribution companies (LDCs) are also considered low risk, they may face more business challenges over the long term. Vertically integrated utilities tilt toward the higher end of the regulated utility risk spectrum because they are engaged in power generation.

At the far end of the broader sector's risk spectrum are holdcos with substantial exposure to unregulated businesses because of their less predictable cash flow generation and greater exposure to market competition. Holdcos with businesses that sell electricity or gas on an unregulated or lightly regulated basis, or operate in markets where both wholesale and retail prices, are primarily set by market mechanisms, tend to have more volatile cash flow. Given the inherent volatility of energy commodity prices and the impact on cash flow, businesses with significant operations in energy marketing and trading and merchant generation face the highest level of business risk. Others at the higher end of the risk spectrum include those engaged in large construction projects.

Exhibit 1

Some holding companies have lowered their business risk profiles, while a couple have increased business risk

Relative business risk levels of North American utility holding companies

	LOWER RISK			HIGHER RISK
↑ IMPROVED	Consolidated Edison	Alliant Energy	ALLETE	
↓ WORSENED	Duquesne Light Holdings	Ameren Corporation	↓ Avangrid	
	↑ Exelon	American Electric Power	Cleco Corporate Holdings	
	Spire	Avista	Dominion Energy	
	Unitil Corporation	Black Hills	NextEra Energy	
		↑ CenterPoint Energy	Otter Tail Corporation	
		CMS Energy	↑ Public Service Enterprise Group	
		↑ DTE Energy	↑ Sempra Energy	
		Duke Energy	Southern Company (The)	
		Edison International	Southwest Gas Holdings	
		El Paso Electric		
		Emera		
		↑ Entergy		
		Evergy		
		↓ Eversource Energy		
		Fortis		
		IDACORP		
		NiSource		
		NorthWestern		
		↑ OGE Energy		
		Pinnacle West Capital		
		PNM Resources		
		PPL		
		Puget Energy		
		WEC Energy Group		
		Xcel Energy		

*The green and red arrows indicate our view that whether the company's business risk has improved or worsened since our last report publication in 2018.
Source: Moody's Investors Service

In recent years, some Baa-rated holding companies have taken steps to reduce business risk. For example, Exelon Corporation's (Baa2 stable) recent spin-off of Constellation Energy Generation, LLC (Baa2 stable), formerly Exelon Generation Company LLC, is one of the most notable examples of a holding company significantly improving its business risk profile. Constellation is one of the largest independent power producers in the US with about 32.4 gigawatts (GW) of generating capacity. All of its generation assets, except for renewable projects, sell power on a merchant basis (i.e., without the benefits of purchase power agreements), which had added to Exelon's overall risk profile. Upon the completion of the spin-off, Exelon Corporation became a fully regulated holdco with low business risk from its diverse portfolio of electric T&D utilities that operate across six states and the District of Columbia. Exelon also benefits from reduced operational risk from no longer owning the nuclear power plants.

Sempra's planned reduction in its ownership interest in Sempra Infrastructure Partners, LP (Baa3 stable) to 70% by the end of 2022 modestly lowers its business risk profile because of the group's decreased exposure to unregulated LNG operations and emerging market risk. Entergy Corporation (Baa2 negative) has also made significant progress in de-risking its business in recent years, through the closure or sale of five merchant nuclear generating units over the last six years. Entergy's remaining merchant plant, the 811-megawatt Palisades Nuclear Generating Station in Michigan, is scheduled to close in May but continues to operate under a purchase power contract until that time.

Along the same lines, Public Service Enterprise Group Incorporated (PSEG, Baa2 stable) reduced its exposure to its higher risk merchant generation assets owned by its unregulated subsidiary PSEG Power, LLC (Baa2 stable). This February PSEG Power completed the sale of its 6,750 MW fossil-fuel generating portfolio, which greatly reduced its exposure to carbon transition risk. Following these divestitures, PSEG Power now has a much smaller merchant generation portfolio that consists only of nuclear generation assets. However, PSEG is also investing in offshore wind power facilities through a minority stake in joint ventures that, although still at an early stage of development, increase PSEG's overall risk profile.

Other utility holding companies are also developing offshore wind projects, including Eversource Energy (Baa1 negative), Avangrid Inc. (Baa2 stable) and Dominion Energy Inc. (Baa2 stable). These companies are mitigating the increased risk of offshore wind development, by either partnering with other companies through joint ventures or by constructing offshore wind projects through a regulated framework and thus earning a return on the investments in rate base. Nonetheless, we view the move into offshore wind development as credit negative because it increases business risk. We expect more holdcos to enter the fray, especially if legislation is passed by the current administration that further supports offshore wind investments.

Some holding companies have taken a variety of other actions with varying implications for business risk. CenterPoint Energy Inc. (Baa2 stable) and OGE Energy Corp. (Baa1 stable), took a significant step last year to de-risk through their joint effort to reduce their ownership interest and control of Enable Midstream Partners LP, which merged with Energy Transfer LP (Baa3 stable). Enable's operations included interstate and intrastate gas pipelines and gathering and processing assets, which exposed CenterPoint and OGE Energy to much higher risk than their remaining regulated utility operations. On 28 March, CenterPoint announced it had divested all of its interests in Energy Transfer. Similarly, DTE Energy Company (Baa2 stable) reduced business risk in July 2021 by spinning off its natural gas pipeline, storage, gathering and processing midstream assets into a separate entity known as DT Midstream, Inc. (Ba1 stable).

Most holdco utilities continue to benefit from credit supportive regulatory jurisdictions

Regulatory supportiveness remains the overarching key credit consideration for most holdcos and their regulated utility subsidiaries. Our views on regulatory support evolve over time based on our observations of regulatory, political, legislative and judicial developments that affect utilities in the sector. As such, the regulatory environment can vary significantly from jurisdiction to jurisdiction. Most of the utilities in the holding company peer group operate in relatively credit supportive regulatory jurisdictions. To provide more differentiation than our 2018 report on this topic, we have broadened the spectrum of regulatory support we use by adding two more buckets to the exhibit below.

Exhibit 2

Most holdco utilities operate within credit supportive regulatory jurisdictions, although the degree of support varies

Spectrum of regulatory support for North American utility holding companies

Source: Moody's Investors Service

NextEra Energy Inc.'s (Baa1 stable) principal subsidiary, Florida Power & Light Company (FPL, A1 stable) operates in the highly credit-supportive regulatory jurisdiction of Florida. The Florida Public Service Commission (FPSC) offers FPL and other state utilities above-average authorized returns and the ability to use several rate adjustment mechanisms that provide for timely cost recovery. For example, the FPSC unanimously approved FPL's multiyear rate settlement agreement last October, based on a forward test year, approving an increase in base rate revenue of up to $1.5 billion over the four-year period 2022-25. The increase was premised on an allowed return on equity (ROE) of 10.6%, and the continuation of an equity ratio that FPL has consistently maintained at about 60%. FPL's rate order followed other constructive FPSC rate decisions for Tampa Electric Company (A3 positive), principal subsidiary of Emera Inc. (Baa3 stable), in October 2021, and Duke Energy Florida LLC (A3 stable), a subsidiary of Duke Energy Corporation (Baa2 stable), in May 2021.

DTE Energy Company and CMS Energy Corporation (Baa2 stable) own utilities that provide electric and gas services to customers in Michigan, which we view as a highly credit supportive regulatory environment. General rate cases in the state are filed using a forward test-year and, by law, must be decided within 10 months of the date of filing, otherwise the utility's application is automatically approved as filed. Utilities operating in the state also benefit from enhanced recovery mechanisms, such as forward-looking adjustment clauses for the cost of gas, fuel and purchased power, transmission and emissions credits. CMS and DTE's gas utilities have revenue decoupling mechanisms, which are intended to adjust for the effects of weather and customer conservation efforts, and infrastructure recovery mechanisms to recoup the cost of services associated with their gas main renewal, meter relocation and pipeline integrity programs.

On a national level, we continue to view regulation under the purview of the Federal Energy Regulatory Commission (FERC) as highly credit supportive, because interstate electric transmission rates are based on a prescriptive and transparent forward-looking formula rate construct. Although authorized returns on equity for electric transmission utilities are lower today than they had been 5-10 years ago, FERC returns are still typically higher than most state-allowed returns. A number of holding companies benefit from substantial ownership of FERC-regulated assets, including PSEG (about 45% of its rate base), Eversource Energy (roughly 35%) and Fortis Inc. (Baa3 stable) (roughly 30%).

Utilities operating in Arizona, Montana, New Mexico, and Washington face greater regulatory challenges

In contrast to most of our holding company peer group, Pinnacle West Capital Corporation (PNW, Baa1 negative), NorthWestern Corporation (Baa2 negative), PNM Resources Inc. (Baa3 stable), Avista Corp. (Baa2 stable), and Puget Energy Inc. (Baa3 stable) are facing regulatory challenges or operate in less credit supportive regulatory environments.

We recently took negative rating actions on PNW and its principal subsidiary, Arizona Public Service Company (APS, A3 negative), and Northwestern for weakened financial profiles that were largely attributed to worsening relationships with state regulators.

In November, we downgraded PNW and APS and maintained negative outlooks on their ratings, prompted by the recent deterioration in Arizona's regulatory environment following the regulator's order on APS' 2019 rate case proceeding, as well as their weakened financial profiles. The rate case proceeding was highly contentious and resulted in a substantial reduction in authorized returns, as well as sizable cost recovery disallowances. As a result, both companies' credit metrics have weakened to well below historical levels.

In March 2021, we changed our outlook on NorthWestern's credit ratings to negative due to financial metrics that were trending lower due in part to regulatory decisions by the Montana Public Service Commission (MPSC). The MPSC, which regulates roughly 80% of the utility's rate base and earnings, has been somewhat less supportive in their regulatory actions than we typically see across other jurisdictions in the US.

New Mexico continues to be a challenging regulatory environment for utilities, reflected in a somewhat less predictable decision-making process. Over the years, PNM Resources' principal utility, Public Service Company of New Mexico (PNM, Baa2 stable), has faced increased regulatory lag in the recovery of prudently incurred costs and investments following regulatory decisions by the New Mexico Public Service Commission.

In the same way, Avista has had a somewhat contentious relationship with Washington state regulators, particularly related to rate adjustment mechanisms that would allow for timely cost recovery. Washington accounts for roughly 60% of Avista's rate base and revenue. Similarly, Puget Energy's principal subsidiary, Puget Sound Energy Inc. (Baa1 stable), has been on the receiving end of inconsistent and less supportive regulatory decisions from Washington state regulators. Washington regulators' focus, of late, has been to limit customer rate increases amid the economic uncertainty caused by the coronavirus pandemic, a social risk that we think can become a more prevalent consideration in an inflationary environment.

Financial metrics are similar for most, although there are both strong and weak outliers

The financial profiles of most Baa-rated utility holdcos, as represented by a projected ratio of CFO pre-W/C to debt between 14% and 16% are similar, although there are both strong and weak outliers. Most notably, those holding companies with financial metrics close to their thresholds for a possible downgrade have the least financial cushion. A diminished financial cushion leaves some holding companies more vulnerable to credit deterioration from an unexpected or damaging external event, such as extreme weather, corporate tax reform or protracted delays in or less constructive rate case outcomes.

Exhibit 3

Projected cash flow coverage ranges from 14% to 16% for most

Ratio of cash flow from operations before working capital changes (CFO pre-W/C) to debt for North American utility holding companies

	ISSUER	%
HIGHER RATIO OF CFO PRE-W/C TO DEBT	Otter Tail	24%
	ALLETE	19
	El Paso Electric	19
	Pinnacle West Capital	18
	Ameren	17
	NextEra Energy	17
	PPL	17
	Southwest Gas Holdings	17
	Consolidated Edison	16
	OGE Energy	16
	Unitil	16
	WEC Energy Group	16
	Xcel Energy	16
	Evergy	16
	Alliant Energy	15
	CenterPoint Energy	15
	CMS Energy	15
	DTE Energy	15
	Public Service Enterprise Group	15
	Sempra Energy	15
	American Electric Power	14
	Avista	14
	Black Hills	14
	Cleco Corporate Holdings LLC	14
	Duke Energy	14
	Edison International	14
	Entergy	14
	Eversource Energy	14
	IDACORP	14
	NorthWestern	14
	PNM Resources	14
	Southern Company (The)	14
	Avangrid	13
	Dominion Energy	13
	Duquesne Light Holdings	13
	Nisource	13
	Puget Energy	13
	Spire	13
LOWER RATIO OF CFO PRE-W/C TO DEBT	Emera	12
	Exelon	12
	Fortis	12

[1] Projected CFO pre-W/C to debt over the next 12 - 18 months.
[2{ Refer to the financial strength ranges outlined in the Regulated Electric and Gas Utilities Methodology.
Source: Moody's Investors Service

Otter Tail Corporation (Baa2 stable) exhibits the strongest credit metrics compared to its Baa holding company peers. Otter Tail's projected ratio of CFO pre-W/C to debt of 24% is consistent with the average of 23.5% it has exhibited over the last six years. The higher financial metric performance can be somewhat attributed to continued strong performance from its higher risk unregulated manufacturing and plastics businesses.

At the other end of the spectrum, Fortis and Emera continue to exhibit weak financial metrics. Their financial profiles continue to be weighed down by significant parent-level debt that was raised largely to finance heavily leveraged acquisitions over five years ago. While Fortis has been able to maintain stable financial metrics at or slightly above its threshold for a potential downgrade, Emera has exhibited little improvement and currently remains below its financial metric threshold for a possible downgrade.

In February 2021, some holdcos' operating utilities were severely impacted by the effects of Winter Storm Uri. The utilities had to increase short-term borrowing to finance higher gas costs, leading to a temporary deterioration in the financial performance of their parent holding companies. With cost recovery largely assured and the use of securitization financing in place to recoup most utilities' excess costs, we expect the affected holding companies, including CenterPoint Energy, Xcel Energy Inc. (Baa1 stable), American Electric Power Company, Inc. (Baa2 stable), Black Hills Corporation (Baa2 stable), and OGE Energy, to exhibit improved financial metrics over the next year.

Parent debt remains high for many holding companies

Nearly half of the 41 holding companies within the peer group have parent-level debt that accounts for at least 25% of consolidated debt, which pressures their credit quality. Holding companies with elevated parent debt can find it more difficult to pay down this debt and improve their overall consolidated metrics, especially if their operating utilities also have weak financial profiles. This makes it difficult to use debt reduction as a way to improve credit metrics quickly, if at all.

High holding company debt can widen the gap between parent and operating utility credit strength, sometimes resulting in multi-notch differences in their respective ratings. The most common driver is the structural subordination of the debt at the holding company. While the operating company services its debt with cash flow from its operations, the holding company relies on dividends and other distributions from its subsidiaries to service its debt obligations, which can be less certain. In addition to the degree of parent leverage, the level of unregulated businesses with higher business risk, as well as any ring-fencing provisions that may exist at the subsidiaries, can also influence credit quality differences.

If interest rates continue to rise, debt refinancing costs will begin to increase, which could be credit negative for holding companies, particularly for those with high debt levels. Unlike a regulated utility, a holding company cannot typically recover rising costs through customer rate increases. Higher interest expenses at a leveraged parent that has no other sources of cash flow will likely therefore increase the burden on its regulated utility.

Exhibit 4

Proportion of parent-level debt is highest at Duquesne Light and Cleco

Percentage of holding company debt at North American utility holding companies

	ISSUER	%
HIGHER % OF HOLDCO DEBT	Duquesne Light Holdings	49*
	Cleco Corporate Holdings LLC	48
	NextEra Energy	46
	DTE Energy Company	43
	Dominion Energy	42
	Emera	38
	CMS Energy	34
	Fortis	34
	Puget Energy	34
	Duke Energy	31
	Avangrid	30
	NiSource	30
	CenterPoint Energy	28
	Eversource Energy	27
	Southern Company (The)	27
	Spire	27
	WEC Energy Group	27
	PNM Resources	25
	Xcel Energy	25
	American Electric Power	24
	Sempra Energy	24
	Public Service Enterprise Group	23
	Entergy	22
	Alliant Energy	20
	Ameren	20
	Evergy	20
	Exelon	20
	Black Hills	19
	PPL	18
	Pinnacle West Capital	17
	Edison International	14
	Unitil	13
	Otter Tail	10
	Consolidated Edison	8
	ALLETE	0
	Avista	0
	El Paso Electric	0
	IDACORP	0
LOWER % OF HOLDCO DEBT	NorthWestern	0
	OGE Energy	0
	Southwest Gas Holdings	0

*NiSource and Black Hills parent-level debt based on estimated proportion of consolidated debt not recoverable in rates.
Source: Moody's Investors Service

(Baa3 stable), Cleco Corporate Holdings LLC (Baa3 stable), NextEra Energy, DTE Energy and Dominion, which have the highest levels of parent leverage among the holding companies, each have a three notch rating differential with their respective principal utility operating company, reflecting this additional credit pressure.

Leverage at the parent has negative implications for both the parent itself (especially when the percentage of consolidated debt at the holding company is high) and for the credit quality of the whole organization, including the operating utilities.

For example, NextEra's parent-level debt accounts for almost half of its consolidated debt, and is a constraint on the credit quality of the entire corporate family, particularly that of its principal utility, FPL. FPL is one of the largest and financially strongest regulated utilities in North America and operates in a highly supportive Florida regulatory environment. Nonetheless, FPL's credit quality remains constrained by high holding company debt at its parent.

This year DTE plans to use proceeds from the spin-off of its midstream gas business to repay approximately $2.7 billion of parent debt, reducing its percentage of holdco debt to slightly below 30% from about 43% currently.

Some holding companies, such as IDACORP Inc. (Baa1 negative), have little or no parent company debt. As a result, the credit quality of IDACORP correlates very closely to that of its principal subsidiary, Idaho Power Company (A3 negative). The same is true for OGE Energy Corp. and principal subsidiary, Oklahoma Gas & Electric Company (A3 stable).

ALLETE, Inc. (Baa1 stable) Avista Corp. (Baa2 stable), El Paso Electric Company (Baa2 stable) and NorthWestern Corporation differ from the other holding companies within the peer group in that these entities are operating utilities. As a result, these entities have no parent-level debt and instead hold debt at the operating entity level.

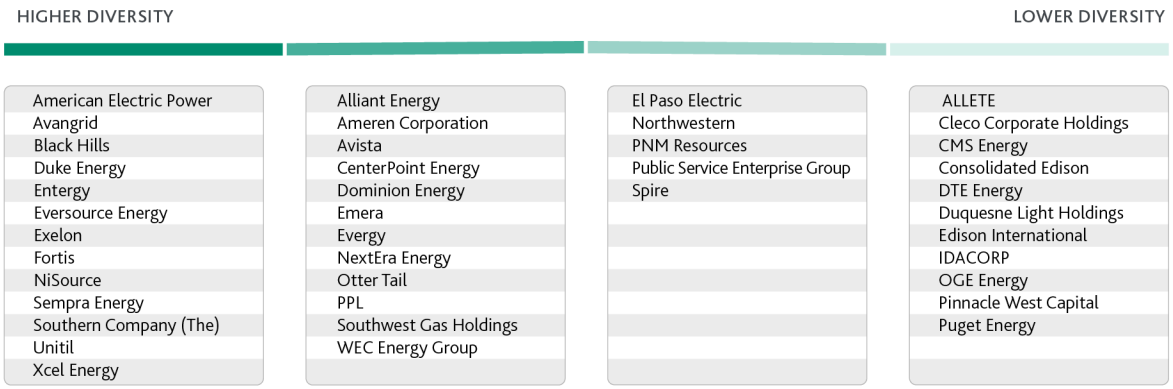
Diversified regulated operations mitigate risk and strengthen credit quality

Geographic diversity may mitigate exposure to less credit supportive regulatory jurisdictions, severe weather events and local economic pressures, while reducing the credit impact that individual subsidiaries can have on the holdco. Diversifying into unregulated businesses, however, a strategy less common today than in years past, may also increase risk. Large holdcos that have a diversified group of primarily regulated utilities, such as Duke, AEP, and Exelon, have substantial regulatory and cash flow diversity that reduces their business risk and strengthens their credit profiles.

Exhibit 5

Holdcos that operate across multiple states or have several businesses benefit from diversification

Spectrum of business diversity among North American utility holding companies



Source: Moody's Investors Service

Some holding companies have deliberately reduced their diversity by exiting non-utility operations, lowering their business risk accordingly, as exemplified by DTE's spin-off of its midstream gas business and Exelon's spin-off of its merchant generation business. Last October, CMS sold its wholly owned lending subsidiary EnerBank USA to Regions Bank (A1 long-term deposit, stable), a subsidiary of Regions Financial Corporation (Baa1 stable). While the bank sale reduced some of the company's business diversity, it also reduced organizational complexity and modestly improved CMS' business risk profile by focusing on its core regulated utility business, Consumers Energy Company (Baa1 stable).

PPL Corporation (PPL, Baa2 positive) is in the midst of changing its mix of regulated operations. PPL is currently a holding company with an electric transmission and distribution (T&D) utility in Pennsylvania and vertically integrated electric utilities in Kentucky after exiting it UK operations. The company is in the process of acquiring a T&D utility in Rhode Island, Narragansett Electric Company (Baa1 review for upgrade), from National Grid, plc (National Grid, Baa2 stable).

On the other hand, large holdcos that have added or are in the process of adding business diversity by increasing unregulated investments in offshore wind, such as Avangrid, Eversource and PSEG, can see their credit quality suffer as a result of these higher risk activities. While we recognize that the energy generated from the offshore wind assets, once constructed and in-service, is sold under long-term contracts with investment grade utility counterparties, wind facilities elevate risk while under construction and returns can be more volatile when compared to regulated utility rate base investments.

Credit impact scores indicate that ESG attributed have a limited impact on ratings

Environmental, social and governance issues have an overall moderately negative credit impact on most regulated electric and gas utility holding companies, as indicated by the median credit impact score of CIS-3.

Among environmental considerations, holdcos typically have high exposure to physical climate risks because of the increasing frequency and severity of extreme weather events that can pose potential threats to their financial performance. In addition to physical damage to utilities' infrastructure, extreme weather events could also add substantial volatility to commodity prices and resource risks. Most holding companies in this group have moderately negative or highly negative exposure to environmental considerations, largely due to their exposure to physical climate risks.

Exhibit 6

ESG issues have an overall moderately negative credit impact

Credit impact scores and issuer profile scores for North American utility holding companies

Company	Environmental Issuer Profile Score	Social Issuer Profile Score	Governance Issuer Profile Score	Credit Impact Score (CIS)
Allete, Inc.	E-3	S-3	G-2	CIS-3
Alliant Energy Corporation	E-3	S-3	G-2	CIS-3
Ameren Corporation	E-3	S-3	G-2	CIS-3
American Electric Power Company, Inc.	E-3	S-3	G-2	CIS-3
Avangrid, Inc.	E-4	S-3	G-3	CIS-3
Avista Corp.	E-3	S-3	G-2	CIS-3
Black Hills Corporation	E-3	S-3	G-2	CIS-3
CenterPoint Energy, Inc.	E-4	S-3	G-2	CIS-3
Cleco Corporate Holdings LLC	E-4	S-3	G-3	CIS-3
CMS Energy Corporation	E-3	S-3	G-2	CIS-3
Consolidated Edison, Inc.	E-4	S-3	G-2	CIS-3
Dominion Energy, Inc.	E-4	S-3	G-2	CIS-3
DTE Energy Company	E-3	S-3	G-2	CIS-3
Duke Energy Corporation	E-4	S-3	G-2	CIS-3
Duquesne Light Holdings, Inc.	E-3	S-3	G-2	CIS-3
Edison International	E-5	S-4	G-2	CIS-4
El Paso Electric Company	E-3	S-3	G-2	CIS-3
Emera Inc.	E-4	S-3	G-3	CIS-3
Entergy Corporation	E-4	S-3	G-2	CIS-3
Evergy, Inc.	E-3	S-3	G-3	CIS-3
Eversource Energy	E-4	S-3	G-2	CIS-3
Exelon Corporation	E-4	S-3	G-3	CIS-3
Fortis Inc.	E-3	S-3	G-2	CIS-3
IDACORP, Inc.	E-3	S-3	G-2	CIS-3
NextEra Energy, Inc.	E-4	S-3	G-2	CIS-3
NiSource Inc.	E-3	S-3	G-2	CIS-3
NorthWestern Corporation	E-3	S-3	G-2	CIS-3
OGE Energy Corp.	E-3	S-3	G-2	CIS-3
Otter Tail Corporation	E-3	S-3	G-2	CIS-3
Pinnacle West Capital Corporation	E-3	S-4	G-2	CIS-3
PNM Resources, Inc.	E-3	S-3	G-2	CIS-3
PPL Corporation	E-3	S-3	G-2	CIS-3
Public Service Enterprise Group Incorporated	E-4	S-3	G-2	CIS-3
Puget Energy, Inc.	E-3	S-3	G-2	CIS-3
Sempra Energy	E-4	S-3	G-2	CIS-3
Southern Company (The)	E-4	S-3	G-3	CIS-3
Southwest Gas Holdings, Inc.	E-3	S-3	G-2	CIS-3
Spire Inc.	E-3	S-3	G-2	CIS-3
Unitil Corporation	E-4	S-3	G-2	CIS-3
WEC Energy Group, Inc.	E-3	S-3	G-2	CIS-3
Xcel Energy Inc.	E-3	S-3	G-2	CIS-3

Source: Moody's Investors Service

The peer group is strongly positioned for carbon transition and is likely to improve further as utilities accelerate retirement of coal-fired generation. Generally the holdcos have a business model that is not expected to be significantly affected by the carbon transition, or have plans in place that substantially mitigate their carbon transition exposure. We believe regulators will support the recovery of most carbon transition costs, though the mechanisms remain undefined or untested in certain jurisdictions.

Regulated utilities, particularly those with generation, generally have a long history of handling progressively more stringent environmental regulations and the ability to recover related costs under well-defined regulatory frameworks (see Carbon transition risk for power generation varies widely by issuer and Generation mix, plant location determine carbon transition risk for regulated utilities outside the US).

In recent years, holdcos have been sharpening their focus on reducing carbon emissions, with most companies setting objectives for net-zero or near-zero carbon emissions by 2050 or earlier. Those that do not own generation, like transmission and distribution (T&D) utility holding companies (e.g. Duquesne Light Holdings) have very low carbon transition risk.

Natural gas distribution holdcos like Spire Inc. (Baa2 stable) may face different, but generally lower, carbon transition risks. It is clear that some state carbon and methane emissions restrictions are already starting to limit demand for natural gas. Right now we currently view natural gas challenges as a long-term risk with varied state and regional implications (see Shifting environmental agendas raise long-term credit risk for natural gas investments).

Almost all of the holdcos have moderately negative exposure to social issues, with the exception of Edison International and Pinnacle West, which have highly negative exposure. Social considerations can influence regulatory actions, such as ensuring reliable and affordable service (customer relations); upholding safety standards related to nuclear power, waste disposal and natural disasters (responsible production); and meeting customer demands for clean energy (demographic and societal changes). Social risk for US regulated electric and gas utilities will increase if electricity and gas prices remain elevated for an extended period, particularly if utility cost increases exceed the overall rate of inflation (see Persistent elevated electric and gas prices will increase social risks).

Exposure to governance risks is neutral to low for most holding companies. For further discussion on how ESG considerations affect the regulated electric and gas utility sector, refer to ESG considerations have an overall credit negative impact on utilities with generation and ESG issues have an overall credit-negative impact; more severe for some subsectors.

Moody's related publications

Issuer research

- Georgia Power Company: As Vogtle nears completion, achieving final milestones will be critical for both credit quality and stakeholder support, 25 January 2022
- Florida Power & Light Company: Florida regulator's final rate case approval is credit positive, 27 October 2021
- Tampa Electric Company/TECO Energy, Inc.: Florida regulator's final rate case order is credit positive, 27 October 2021
- National Grid plc: Proposed rate case settlement in downstate New York finally filed; challenges persist for gas businesses, 21 May 2021
- Puget Sound Energy, Inc. and Avista Corp.: Legislation supporting multi-year rate plans has credit positive implications for Washington's investor owned utilities, 10 May 2021

Sector research

- Regulated Electric and Gas Utilities – US: Persistent elevated electric and gas prices will increase social risks, 14 February 2022
- Regulated Networks and Unregulated Utilities – Global: ESG issues have an overall credit-negative impact; more severe for some subsectors, 7 December 2021
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- Regulated Electric Utilities – US: High holdco debt limits financial flexibility, heightens vulnerability to external shocks, 23 February 2021
- Electric Utilities and Power Generators – US: Carbon transition risk for power generation varies widely by issuer, 2 December 2020
- Regulated Electric and Gas Utilities - US: Latest political intervention into regulatory oversight is credit negative for New York utilities, 13 November 2020
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MOODY'S INVESTORS SERVICE

Allowed ROEs and Equity Ratios for New York State Water Companies

					Company Requested		Staff Recommended		Authorized				
Company Name	Term	Type of Outcome	Case #	Date of Decision	ROE	Equity Ratio	ROE[1]	Equity Ratio[1]	ROE	Equity Ratio	Short-term Debt	Long-term Debt	Preferred Stock
Suez Water New York	4-Year	Negotiation	19-W-0168	Jul 16 2020	10.00%	50.00%	8.35%	46.00%	8.80%	48.00%		4.40%	
Suez Water Owego-Nichols	3-Year	Negotiation	17-W-0528	Jul 13 2018	9.30%	54.31%	8.50%	46.00%	8.90%	46.00%		4.65%	
New York American Water	4-Year	Negotiation	16-W-0259	May 18 2017	10.75%	48.00%	8.55%	45.10%	9.10%	46.00%		4.39%	
Suez Water New York	3-Year	Negotiation	16-W-0130	Jan 24 2017	9.30%	50.00%	8.50%	47.00%	9.00%	46.00%		5.15%	
United Water New Rochelle[2,3]	3 year	Negotiation	13-W-0539	Nov 14 2014	10.55%	53.64%	8.71%	45.43%	9.20%	47.00%		6.03%	
United Water Westchester[2,3]	3 year	Negotiation	13-W-0564	Nov 14 2014	10.55%	53.64%	8.71%	45.43%	9.20%	47.00%		6.03%	
United Water New York[2]	1 year	Litigated	13-W-0295	Jun 26 2014	10.85%	52.13%	8.75%	44.00%	9.00%	44.00%		5.07%	
United Water New York[2]	2-yr option	Option		Jun 26 2014					9.20%	44.00%			
United Water Owego-Nichols[3]	3-Year	Negotiation	11-W-0082	Mar 21 2012	10.90%	52.20%	10.00%	39.33%	9.58%	44.35%		6.03%	
Long Island Water Corp.[4]	3-Year	Negotiation	11-W-0200	Mar 20 2012	11.50%	43.38%	8.90%	43.76%	9.65%	42.00%		5.81%	4.50%
United Water Westchester[2,3]	4-Year	Negotiation	09-W-0828	Dec 17 2010	11.40%	51.12%	9.30%	41.30%	10.00%	45.00%		6.14%	
United Water New Rochelle[2,3]	4-Year	Negotiation	09-W-0824	Oct 15 2010	11.35%	51.12%	9.60%	41.30%	10.00%	45.00%		6.14%	
United Water New York[2]	3-Year	Negotiation	09-W-0731	Jul 20 2010	11.55%	48.46%	9.80%	39.00%	10.20%	45.00%	2.44%	5.64%	4.70%
New York Water Service Corp.[3]	3-Year	Negotiation	09-W-0237	Jan 29 2010	10.50%	50.14%	10.30%	45.70%	10.50%	46.80%		5.53%	
United Water New York[2]	3-year	Negotiation	06-W-0131	Dec 14 2006	11.10%	45.68%	9.20%	45.68%	9.60%	45.68%	4.33%	5.74%	4.71%

[1] Staff's recommendation for a one year rate plan.

[2] United Water New York, United Water Westchester, and United Water Owego-Nichols are now known as Suez Water New York, Suez Water Westchester, and Suez Owego-Nichols, respectively. Their parent company, Suez Environment North America, rebranded the companies in November 2015.

[3] United Water Westchester and United Water New Rochelle merged and became United Water Westchester in Case 14-W-0006, Order issued on November 14, 2014.

[4] Long Island Water (d/b/a Long Island American Water), New York Water Service, Aquarion Water Company of Sea Cliff and Aqua New York merged and became New York American Water Co. in Case 12-W-0217, issued on August 17, 2012.

* Suez Water New York, Suez Water Westchester, and Suez Water Owego-Nichols are in a pending merger to become Suez Water New York in Case 19-W-0168.

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On Forecasting Long-Term Interest Rates: Is the Success of the No-Change Prediction Surprising?

DR JAMES E. PESANDO*

I. Introduction

IN A RECENT ARTICLE in this Journal, Elliott and Baier [1] provide empirical evidence that the no-change forecast decidedly outperforms the "unconditional predictions" of long-term interest rates associated with the Modigliani-Sutch, Modigliani-Shiller and other well-known models of interest rate determination. The authors use "unconditional predictions" to refer to forecasts generated by variants of these models in which the current long-term rate is regressed on the relevant sets of exogenous variables lagged one period. These regressions—and the subsequent forecasts—are "unconditional" in the sense that they restrict the information set used to track long-term interest rates to that which is known at the beginning of the period.

The crucial issue that the authors do not address, however, is whether the superior forecasting performance of the no-change prediction is or is not surprising on à priori grounds. This issue is of extreme importance in interpreting their findings. One possible interpretation of the Elliott-Baier results, for example, is that the specific information sets associated with the six models are not valuable in a forecasting context, but other information sets may be. In fact, the empirical results reported by Elliott-Baier are not surprising in view of the accumulating evidence that (1) the bond market is efficient and (2) term premiums, if they exist, are time-invariant. These results imply, in effect, that short-term movements in long-term interest rates will not be "forecastable". This important point is reviewed briefly below.

II. The No-Change Prediction: A "Naive" Forecast?

The fact that long-term interest rates will approximately follow a martingale sequence under the conditions described above, and hence that the no-change prediction will approximate the optimal forecast, has been shown by both Sargent (1976) and Pesando (1978). Let $R_{n,t}$ denote the interest rate (for simplicity) on an n-period, non-coupon, bond in period t, ϕ_t the information available to the market in period t, and ${}_{t+i}f_{1,t}$ the forward rate at time t for the one-period bond rate in period $t + i$. Then, under the joint hypothesis of market efficiency and the pure

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expectations model of the term structure, the ex ante changes in the long-term rate can be approximated as follows:

$$E(\tilde{R}_{n,t} \mid \phi_{t-1}) - R_{n,t-1} = \frac{1}{n}*[E(_{t+n-1}\tilde{f}_{1,t} \mid \phi_{t-1}) - R_{1,t-1}] \quad (1)$$

The term on the right-hand side of equation (1), which represents the nonoverlapping one-period rates, clearly approaches zero as n gets large. In this case, the optimal forecast of the long-term rate is simply its current value; that is, the optimal forecast is the no-change extrapolation. If $\Psi_{n,t}$ represents the term premium accorded an n-period bond in period t, then (1) may be rewritten as:

$$E(\tilde{R}_{n,t} \mid \phi_{t,1}) - R_{n,t-1} = \frac{1}{n}*[E(_{t+n-1}\tilde{f}_{1,t} \mid \phi_{t-1}) - R_{1,t-1}] + E(\tilde{\psi}_{n,t} \mid \phi_{t-1}) - \psi_{n,t-1} \quad (2)$$

If this term premium is constant, then (2) simply reduces to (1) and the previous result holds.

Elliott-Baier employ monthly data in their forecasting experiments. Assume, for the sake of argument, that the several long-term rates employed in their study have a representative term to maturity of 10 years. (The synthetic series of U.S. Government bonds employed in the study has an exact maturity of 15 years.) If interest rates are expressed at annual rates, then n equals 120 and thus the ex ante change defined in (1) must be very close to zero, unless the short-term rate is "very" nonstationary. Suppose, for example, that $R_{1,t-1}$ equals five per cent (.05) and that $E(_{t+n-1}\tilde{f}_{1,t} \mid \phi_{t-1})$ equals 10 per cent, which would be consistent with a sharply rising yield curve. The ex ante change in the long-term rate, in spite of the 500 basis point difference in the respective short-term rates, is only 500 ÷ 120 or approximately 4 basis points. Note, by way of contrast, that if the unit of observation were annual rather than monthly, these same figures would imply—since n would equal 10—an ex ante change of more than 40 basis points in the long-term rate. These figures highlight the fact that it is short-run movements in long-term rates which are not likely to be "forecastable" under the joint hypothesis of market efficiency and a time-invariant term premium.

For non-coupon bonds, as noted by Pesando [5] the expression analogous to (1) is more complicated, but the martingale approximation remains quite close. Intuitively, the martingale approximation—and hence the random walk characteristic of long-term rates—stems from the fact that over short time intervals (one month in the case at hand), the percentage change in bond prices necessary to equate the ex ante returns on short- and long-term securities (up to a time-invariant term premium) is very small. As a result, the implied ex ante changes in long-term rates are very close to zero. In a recent paper (Pesando 1979a), I calculated—for quarterly data—the ex ante changes in long-term Government of Canada and long-term Canadian corporate bonds implied by their yields and the yields on 90-day Treasury Bills and 90-day finance company paper, respectively.[1]

[1] For purposes of these calculations, the (assumed) constant term premiums were set equal to the mean spreads between short- and long-term interest rates in the sample period. The representatives terms to maturity for the two interest rate series were assumed to equal 17 years, although complications posed by call options and sinking funds may cloud the interpretation of this figure in the case of corporate bonds.

The mean absolute values of the ex ante changes in these long-term rates for the sample period 1957:1–1979:1 equalled 2.07 basis points and 2.60 basis points, respectively. If monthly data were employed, the corresponding ex ante changes would be approximately one-third as large. With monthly data, the mean absolute values of the ex ante changes in Government of Canada and Canadian corporate bonds would thus be less than a single basis point. Clearly, if the bond market is efficient and if the term premium accorded long-term interest rate is time-invariant, then agents without access to inside information are not likely to be able to forecast short-term movements in long-term interest rates.

III. Conclusion

Those who work in the capital asset pricing framework of modern finance theory tend to treat the term premium—which is related to the covariance of bond returns and the return to the market portfolio—as constant over time. Many—if not most—of those who have conducted empirical studies of the determinants of term premiums have concluded that they may well be time-invariant. In the absence of convincing evidence of the existence of time-varying term premiums, and in view of the strong à priori belief in market efficiency, the success of the "no-change" prediction in the forecasting experiments conducted by Elliott-Baier is not surprising. Short-run movements in long-term interest rates, quite simply, are not likely to be "forecastable". The failure of recorded forecasts to outperform the no-change prediction of the martingale model, in both the United States (Prell [6], Fraser [2]) and Canada (Pesando [3]), is also noteworthy in this regard.

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JUST HOW BAD ARE ECONOMISTS AT PREDICTING INTEREST RATES? (AND WHAT ARE THE IMPLICATIONS FOR INVESTORS?)

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On January 2, 1997, the *Wall Street Journal* published its semiannual survey of economists. Most of the fifty-seven economists surveyed predicted that the yield on the thirty-year Treasury bond, then at 6.64%, would drop by July 1. The consensus estimate for this yield was 6.52%.

Fears of inflation, however, have recently caused interest rates to rise. The yield at the time of this writing in mid-April is over 7%. Thus, barring a major downward shift in interest rates, economists will have wrongly predicted the direction of interest rates.

Some readers will not be surprised by this result, for economists have a notoriously bad reputation for huge forecasting errors. But just how bad are economists at predicting interest rates? And if these experts, whose careers often depend on the accuracy of their predictions, cannot predict interest rates, what are the implications for actively managed bond funds?

I address these questions by analyzing the *Wall Street Journal* survey of economists.

THE DATA AND RESULTS

Economists are employed in nearly all segments of the economy. One of the primary duties of economists in the financial sector is to forecast the economy, or, more specifically, to forecast important economic data such as GDP growth, inflation, and interest rates. Every six months, in late December and late June, the *Wall Street Journal* surveys a group of economists, asking for their forecasts of interest rates, GDP growth, inflation, and the value of the dollar against the yen. The forecasts are published in the first week of January and July.

The participating economists work primarily in the financial sector, most notably investment banks and commercial banks. Only three of the fifty-seven economists participating in the December 1996 survey were then in academia. The number of economists participating has increased steadily from twelve in 1981 to about sixty in the mid-1990s.

The economists have been predicting, six months in advance, the yield on three-month Treasury bills and thirty-year Treasury bonds since December 1981. Each economist provides an estimate for each interest rate, and then a consensus estimate is calculated, which is simply the arithmetic mean of all the estimates.

Can economists predict interest rates? The answer is emphatically "no," regardless of the measure used.

There have been thirty six-month surveys completed since December 1981. The Exhibit provides the consensus estimate and the actual yield for the three-month and thirty-year Treasury securities.

Rates on three-month Treasury bills moved in the *opposite* direction of the consensus prediction in sixteen of these contests (53%). That economists predicted the direction of short-term interest rates correctly almost half of the time is the good news. The bad news is that the consensus estimate for the thirty-year Treasury bond has been in *the wrong direction* in twenty of the thirty contests (67%).

The average error for the consensus estimate is 79 basis points for the Treasury bill, and 86 basis points for the thirty-year bond. Assuming interest rates would stay the same each period yields average errors of 74 and 78 basis points, respectively. Thus, investors who assumed interest rates would remain constant were more accurate than the consensus estimate.

Incorrectly forecasting the direction of interest rates is not very costly for investors if rates move very little. In fact, economists have been least accurate when interest rate changes were largest! The rates on the three-month Treasury bill moved 100 basis points or more on ten occasions. The consensus estimate was in the right direction on six of these occasions, yet the consensus underestimated the move by an average of 99 basis points.

EXHIBIT
WALL STREET JOURNAL CONSENSUS INTEREST RATE FORECAST

	3-MONTH TREASURY BILL			30-YEAR TREASURY BOND		
DATE PUBLISHED	CONSENSUS FORECAST (%)	ACTUAL YIELD (%)	CORRECT DIRECTION?	CONSENSUS FORECAST (%)	ACTUAL YIELD (%)	CORRECT DIRECTION? (%)
Jan-82	11.06	12.43	Wrong	13.05	13.92	Wrong
Jul-82	11.61	11.08	Right	13.27	13.62	Right
Jan-83	7.37	8.75	Right	10.11	10.98	Right
Jul-83	8.60	8.95	Wrong	10.59	11.87	Wrong
Jan-84	8.72	9.90	Wrong	11.39	13.64	Wrong
Jul-84	10.64	7.84	Wrong	13.78	11.53	Wrong
Jan-85	8.56	6.83	Wrong	11.60	10.44	Wrong
Jul-85	7.31	7.08	Right	10.51	9.27	Wrong
Jan-86	6.96	5.98	Right	9.45	7.28	Wrong
Jul-86	6.14	5.66	Wrong	7.63	7.49	Right
Jan-87	4.98	5.73	Wrong	7.05	8.50	Wrong
Jul-87	5.91	5.67	Wrong	8.45	8.98	Wrong
Jan-88	5.70	6.54	Right	8.65	8.83	Right
Jul-88	6.77	8.09	Right	9.36	8.99	Right
Jan-89	8.29	7.98	Wrong	9.25	8.04	Wrong
Jul-89	7.76	7.79	Right	8.12	7.97	Wrong
Jan-90	7.03	7.98	Wrong	7.62	8.40	Wrong
Jul-90	7.56	6.62	Right	8.16	8.24	Right
Jan-91	6.14	5.62	Right	7.65	8.41	Wrong
Jul-91	5.84	3.93	Wrong	8.22	7.39	Right
Jan-92	3.80	3.63	Right	7.30	7.78	Wrong
Jul-92	3.54	3.15	Right	7.61	7.39	Right
Jan-93	3.41	3.07	Wrong	7.44	6.67	Wrong
Jul-93	3.34	3.05	Wrong	6.84	6.34	Wrong
Jan-94	3.40	4.15	Right	6.26	7.61	Wrong
Jul-94	4.67	5.70	Right	7.30	7.87	Wrong
Jan-95	6.50	5.44	Wrong	7.94	6.62	Wrong
Jul-95	5.45	5.08	Wrong	6.62	5.94	Wrong
Jan-96	4.90	5.15	Wrong	6.00	6.89	Right
Jul-96	5.31	5.19	Right	6.86	6.64	Right
Jan-97	5.10	?	?	6.52	?	?

Again, this is the good news. The yield on the thirty-year bond has moved more than 100 basis points on ten occasions. The consensus estimate was in the *wrong direction* on eight of these occasions. One of the two correct guesses was a consensus estimate of a 19-basis point drop when rates dropped 102 basis points. Economists therefore essentially missed on nine of the ten biggest interest rate movements in the last fourteen years.

The survey data from the *Wall Street Journal* clearly show that economists a group cannot predict interest rates. Might there be some individual economists, however, who can successfully predict interest rates? Further analysis suggests everyone is almost equally inaccurate.

Forty-four economists have participated in ten or more contests. Of these, only thirteen participants guessed the right direction of long-term interest rates more than 50% of the time; none of these professionals exceeded a 60% accuracy rate.[1] The median accuracy rate is 44%. The figures are only slightly better for the three-month rate, with twenty-four economists above 50%, and one expert actually getting the direction right two-thirds of the time.

For a final test, I examined future predictions of the economists with the most accurate predictions to determine if success could continue for the short term. The three economists in each survey with the closest prediction for the thirty-year bond were examined, although ties cause as many as seven economists to be included in this winner's bracket. Only 44% of these economists (48 of 108) were in the top half of the next survey, suggesting that economists with the closest forecasts cannot repeat their performance.

IMPLICATIONS FOR INVESTORS

The inability of economists to forecast interest rates has important implications for investors. Bond prices depend almost entirely on two factors: default risk and interest rates.[2] To earn above-market returns in the bond market, one needs to be able to predict default risk or interest rates better than the market. Bond rating agencies like Moody's and Standard & Poor's do an outstanding job at predicting default risk. Consequently, it is improbable that fixed-income fund managers can predict default risk better than the market consensus.

The ability to earn above-market returns in bonds then boils down to predicting interest rates correctly, but my analysis of the *Wall Street Journal* survey clearly shows that economists working for top investment banks, commercial banks, money management firms, and investment newsletters have no ability in this department.

If fund managers cannot accurately predict interest rates, actively managed bond funds have no edge over passively managed funds. Once management fees are factored in, the advantage goes to index funds. Indeed, there is overwhelming evidence that the bond market is brutally efficient, and the performance of bond managers reflects this efficiency.

For example, as of June 1, 1996, only 23.4% of taxable bond funds and 33.9% of tax-free bond funds had a one-year record better than the relevant bond index, compared with 44.1% of general equity funds and 58.5% of aggressive growth funds. In a longer-term study, Firman [1994] observes that only 128 of 800 fixed-income pension managers (16%) have a ten-year record better than the relevant bond index.[3]

CONCLUSION

Economists participating in the *Wall Street Journal* forecasting survey have no ability to predict interest rates. Since interest rates cannot be predicted, bond managers have no reliable method with which to earn above-market returns. Instead, actively managed bond funds, shackled by management fees, and with no superior ability to predict interest rates, have generally underperformed the relevant bond index. Bond index funds should appeal to investors for this reason.

ENDNOTES

[1]Six participants in the most recent survey predicted the yield on the thirty-year Treasury bond out to the second decimal point (e.g., 6.79% instead of rounding to 6.8%).

[2]Some bonds are also subject to changes in the tax code, as the inverse relationship between the price of municipal bonds and the popularity of flat tax proposals clearly indicates.

[3]See Blake, Elton, and Gruber [1993] for further evidence. For an overview on the efficiency of capital markets, see Fama [1991].

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Discount Cash Flow Model
Electric, Gas and Water Proxy Group

	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
	Company[1]	Ticker	Beta[2]	Stock Price[3] Mar-May 2023	EPS 2027	DPS 2023	DPS 2024	DPS 2027	BPS 2023	BPS 2024	BPS 2027	Number of Shares 2023	Number of Shares 2027
1.	Allete, Inc	ALE	0.90	62.73	5.00	2.71	2.79	3.00	49.10	51.25	54.00	58.00	61.00
2.	Alliant Energy Corp.	LNT	0.85	53.06	3.80	1.81	1.92	2.29	26.55	27.80	31.90	255.80	257.00
3.	Ameren Corp.	AEE	0.85	85.77	5.50	2.52	2.65	3.30	40.20	42.90	55.00	267.00	285.00
4.	American Electric Pow	AEP	0.75	89.90	6.80	3.35	3.52	4.16	52.60	55.05	62.55	523.00	550.00
5.	Avista Corp	AVA	0.90	42.47	3.00	1.84	1.92	2.15	32.55	34.10	36.75	77.00	85.00
6.	Black Hills Corp.	BKH	0.95	62.96	5.25	2.53	2.65	3.07	47.35	49.65	59.70	67.50	72.00
7.	Centerpoint Energy	CNP	1.10	29.32	1.85	0.77	0.83	0.95	16.70	17.40	19.00	631.00	634.00
8.	CMS Energy Corp.	CMS	0.80	60.37	3.75	1.95	2.04	2.30	25.20	25.40	26.00	292.00	300.00
9.	Consolidated Edison	ED	0.75	95.39	6.00	3.24	3.34	3.86	58.70	60.55	66.75	345.00	345.00
10.	Dominion Energy	D	0.85	54.90	5.00	2.67	2.75	3.18	32.95	34.85	42.15	842.00	870.00
11.	Duke Energy	DUK	0.85	95.43	7.00	4.06	4.14	4.30	64.50	66.25	70.00	770.00	770.00
12.	Edison International	EIX	0.95	69.66	6.45	2.95	3.05	3.65	37.00	40.00	48.50	384.00	390.00
13.	Entergy Corp.	ETR	0.95	104.77	6.50	4.30	4.45	5.00	62.55	64.95	73.00	214.00	230.00
15.	Evergy Inc.	EVRG	0.90	60.30	4.85	2.53	2.61	3.05	42.70	44.10	47.50	230.00	230.00
14.	Eversource	ES	0.90	75.91	5.60	2.70	2.86	3.48	46.40	48.65	55.50	351.50	360.00
16.	Hawaiian Electric	HE	0.85	37.98	3.00	1.44	1.48	1.64	21.70	22.55	28.05	110.50	114.00
17.	IDACORP, Inc.	IDA	0.80	107.24	6.30	3.20	3.40	4.15	57.85	60.20	67.00	51.00	53.00
18.	NextEra Energy	NEE	0.95	75.14	4.40	1.87	2.06	2.74	22.20	23.50	30.00	2025.00	2050.00
19.	NorthWestern Corp.	NWE	0.90	57.64	4.15	2.56	2.60	2.76	47.50	48.50	52.30	62.00	62.00
20.	OGE Energy Corp.	OGE	1.00	36.76	3.15	1.70	1.78	1.85	22.25	23.10	26.00	200.20	200.20
21.	Pinnacle West Capital	PNW	0.90	78.13	5.70	3.48	3.54	3.75	54.00	56.50	61.75	113.50	120.00
22.	Portland General Elec	POR	0.85	48.82	3.65	1.88	1.98	2.36	32.90	34.75	38.70	94.50	100.00
23.	PPL	PPL	1.05	27.44	2.10	0.96	1.03	1.26	19.50	20.15	22.45	737.00	738.00
24.	Public Service Enterpr	PEG	0.90	61.26	4.50	2.28	2.40	2.80	28.75	30.10	35.00	500.00	500.00
25.	Sempra Energy	SRE	0.95	149.87	12.00	4.76	5.00	6.10	85.55	90.20	105.55	305.00	300.00
26.	Southern Co.	SO	0.90	69.95	5.15	2.78	2.86	3.10	28.00	29.90	32.25	1070.00	1070.00
27.	WEC Energy Group	WEC	0.80	93.03	5.90	3.12	3.33	3.80	37.35	37.90	42.00	315.43	315.43
28.	Xcel Energy, Inc.	XEL	0.80	67.34	4.25	2.08	2.22	2.66	31.60	33.15	38.25	550.00	560.00
29.	American States Wate	AWR	0.70	88.92	3.40	1.62	1.72	2.30	20.15	21.35	24.55	37.50	37.50
30.	American Water Work	AWK	0.90	144.88	6.10	2.82	3.05	3.80	50.15	51.75	57.25	193.00	200.00
31.	California Water Servi	CWT	0.70	56.88	2.75	1.04	1.12	1.35	25.75	27.10	29.50	53.00	50.00
32.	Essential Utilities	WTRG	0.95	42.53	2.35	1.20	1.28	1.65	21.30	22.80	25.95	268.00	285.00
33.	Middlesex Water Co	MSEX	0.75	75.67	3.00	1.28	1.35	1.60	22.85	23.35	23.70	17.85	18.00
34.	SJW Group	SJW	0.80	76.42	3.25	1.52	1.60	1.80	38.35	40.00	42.50	30.00	30.00

Electric & Water Average: 0.87

Sources:
[1]Value Line Electric Industry Central, as of March 2022.
[1]Value Line Electric Industry East, as of May 2023.
[1]Value Line Electric Industry West, as of April 2023.
[1]Value Line Gas Utility Industry, as of May 2023.
[1]Value Line Water Utility Industry, as of April 2023.
[2]Beta data is from Value Line Investment Survey.
[3]Historical price data is from S&P Capital IQ

Discount Cash Flow Model
Electric, Gas and Water Proxy Group

	(B)	(N)	(O)	(P)	(Q)	(R)	(S)	(V)	(W)	(X)
	Company[1]	DPS Growth 2027	Retention Rate 2027	Return on Equity 2027	B x R	S Increase in Shares	V MBR -1 2023	S x V	Sustainable Growth	Long Form ROE
1.	Allete, Inc	2.45	0.40	9.34	3.74	1.27	0.28	0.35	4.09	8.29%
2.	Alliant Energy Corp.	6.05	0.40	12.19	4.84	0.12	1.00	0.12	4.96	8.58%
3.	Ameren Corp.	7.59	0.40	10.41	4.17	1.64	1.13	1.86	6.03	9.14%
4.	American Electric Pov	5.73	0.39	11.10	4.31	1.27	0.71	0.90	5.21	9.07%
5.	Avista Corp	3.84	0.28	8.27	2.34	2.50	0.30	0.76	3.10	7.63%
6.	Black Hills Corp.	5.03	0.42	9.06	3.76	1.63	0.33	0.54	4.30	8.49%
7.	Centerpoint Energy	4.60	0.49	9.88	4.81	0.12	0.76	0.09	4.90	7.63%
8.	CMS Energy Corp.	4.08	0.39	14.48	5.60	0.68	1.40	0.95	6.54	9.64%
9.	Consolidated Edison	4.94	0.36	9.13	3.26	0.00	0.63	0.00	3.26	6.84%
10.	Dominion Energy	4.96	0.36	12.24	4.45	0.82	0.67	0.55	5.00	9.89%
11.	Duke Energy	1.27	0.39	10.09	3.89	0.00	0.48	0.00	3.89	7.91%
12.	Edison International	6.17	0.43	13.73	5.96	0.39	0.88	0.34	6.30	10.55%
13.	Entergy Corp.	3.96	0.23	9.08	2.09	1.82	0.67	1.23	3.32	7.56%
15.	Evergy Inc.	5.33	0.37	10.34	3.84	0.00	0.41	0.00	3.84	8.23%
14.	Eversource	6.76	0.38	10.31	3.90	0.60	0.64	0.38	4.28	8.19%
16.	Hawaiian Electric	3.48	0.45	11.08	5.02	0.78	0.75	0.59	5.61	9.23%
17.	IDACORP, Inc.	6.87	0.34	9.57	3.27	0.97	0.85	0.82	4.09	7.40%
18.	NextEra Energy	9.98	0.38	15.26	5.76	0.31	2.38	0.73	6.49	9.36%
19.	NorthWestern Corp.	2.01	0.33	8.03	2.69	0.00	0.21	0.00	2.69	7.08%
20.	OGE Energy Corp.	1.29	0.41	12.35	5.10	0.00	0.65	0.00	5.10	9.44%
21.	Pinnacle West Capital	1.94	0.34	9.37	3.20	1.40	0.45	0.63	3.83	8.10%
22.	Portland General Elec	6.03	0.35	9.60	3.39	1.42	0.48	0.69	4.08	8.24%
23.	PPL	6.95	0.40	9.52	3.81	0.03	0.41	0.01	3.82	7.77%
24.	Public Service Enterpr	5.27	0.38	13.18	4.98	0.00	1.13	0.00	4.98	8.83%
25.	Sempra Energy	6.85	0.49	11.67	5.74	0.00	0.75	0.00	5.74	9.06%
26.	Southern Co.	2.72	0.40	16.17	6.44	0.00	1.50	0.00	6.44	10.09%
27.	WEC Energy Group	4.50	0.36	14.29	5.09	0.00	1.49	0.00	5.09	8.53%
28.	Xcel Energy, Inc.	6.21	0.37	11.38	4.26	0.45	1.13	0.51	4.77	8.09%
29.	American States Wate	10.17	0.32	14.17	4.58	0.00	3.41	0.00	4.58	6.70%
30.	American Water Work	7.60	0.38	10.83	4.09	0.89	1.89	1.69	5.78	7.87%
31.	California Water Servi	6.42	0.51	9.45	4.81	0.00	1.21	0.00	4.81	6.76%
32.	Essential Utilities	8.83	0.30	9.25	2.76	1.55	1.00	1.54	4.30	7.56%
33.	Middlesex Water Co	5.83	0.47	12.69	5.92	0.21	2.31	0.48	6.41	8.03%
34.	SJW Group	4.00	0.45	7.72	3.45	0.00	0.99	0.00	3.45	5.49%
	Electric & Water Ave									**8.27%**

Cost of Equity Calculation
Staff Electric & Water Proxy Group

Cost of Market[1]:	*Implied*	*Required*
March 2023	10.70%	11.00%
April 2023	10.60%	10.90%
May 2023	10.60%	10.90%
Cost of Market	10.78%	

Treasury Rates[2]:	*10 year*	*30 year*
March 2023	3.66%	3.77%
April 2023	3.46%	3.68%
May 2023	3.57%	3.86%
Risk Free Rate	3.67%	

Market Risk Premium (MRP): 7.11%

Proxy Group Beta	0.87	
Traditional CAPM ROE	9.88%	
Zero Beta CAPM ROE	10.11%	**Average**
Overall CAPM ROE	10.00%	
DCF ROE	8.27%	

Return on Equity 2/3 DCF 1/3 CAPM Weighting	**8.85%**	Average

Sources:

[1] Bank of America Securities, Quantitative Profiles Reports - data is average of Implied and Required Returns for S&P 500.

[2] Federal Reserve Bank of St. Louis, Federal Reserve Economic Data (FRED)

Staff's 2023 Proxy Group Universe

No. Selected	Total No.	Company Name	Ticker	Industry	2022 S&P Credit Ratings [6]	2022 Moody's Credit Ratings [6]	2022 % Utility Revenue	Reason for Exclusion
				Electric Utility (East), February 3, 2023				
	1	AVANGRID Inc.	AGR	East1	BBB+	Baa2	82.6%	M&A Activity
1	2	Consolidated Edison Inc	ED	East[1]	A-	Baa2	93.5%	
2	3	Dominion Energy	D	East[1]	BBB+	Baa2	83.9%	
3	4	Duke Energy Corp New	DUK	East[1]	BBB+	Baa2	99.0%	
4	5	Eversource Energy	ES	East[1]	A-	Baa1	100.0%	
	6	Exelon Corp	EXC	East[1]	BBB+	Baa2	99.2%	Lacks beta from Value Line
	7	FirstEnergy Corp	FE	East[1]	BBB-	Ba1	99.1%	Lacks credit rating
5	8	NextEra Energy Inc	NEE	East[1]	A-	Baa1	82.5%	
6	9	PPL Corp.	PPL	East[1]	A-	Baa1	99.7%	
7	10	Public Service Enterprise Group Inc	PEG	East[1]	BBB+	Baa2	75.9%	
8	11	Southern Co	SO	East[1]	BBB+	Baa2	80.0%	
	12	Unitil Corp	UTL	East[1]	BBB+	Baa2	100.0%	Lacks dividend forecasts from Value Line
				Electric Util. (Central), February 3, 2023				
1	13	Allete Inc	ALE	Central[2]	BBB	Baa1	80.2%	
2	14	Alliant Energy Corp	LNT	Central[2]	A-	Baa2	97.8%	
3	15	Ameren Corp	AEE	Central[2]	BBB+	Baa1	100.0%	
4	16	American Electric Power Co. Inc	AEP	Central[2]	A-	Baa2	86.5%	
5	17	CenterPoint Energy Inc	CNP	Central[2]	BBB+	Baa2	96.7%	
6	18	CMS Energy Corp	CMS	Central[2]	BBB+	Baa2	94.8%	
	19	DTE Energy Company	DTE	Central[2]	BBB+	Baa2	42.9%	Regulated revenue below 70%
7	20	Entergy Corp	ETR	Central[2]	BBB+	Baa2	97.5%	
8	21	Evergy Inc.	EVRG	Central[2]	A-	Baa2	80.4%	
	22	Fortis Inc	FTS	Central[2]	A-	Baa3	98.6%	Foreign exchange risk
	23	MGE Energy Inc [5]	MGEE	Central[2]	AA-	A1	100.0%	Lacks dividend forecasts from Value Line
9	24	OGE Energy Corp	OGE	Central[2]	BBB+	Baa1	97.9%	
	25	Otter Tail Corp	OTTR	Central[2]	BBB	Baa2	37.6%	Regulated revenue below 70%
10	26	WEC Energy Group	WEC	Central[2]	A-	Baa1	98.2%	
				Electric Utility (West), February 3, 2023				
1	27	Avista Corp	AVA	West[3]	BBB	Baa2	100.0%	
2	28	Black Hills Corp	BKH	West[3]	BBB+	Baa2	95.5%	
3	29	Edison International	EIX	West[3]	BBB	Baa2	99.7%	
4	30	Hawaiian Electric Industries Inc [5]	HE	West[3]	BBB-	Baa1	91.1%	
5	31	IDACORP Inc	IDA	West[3]	BBB	Baa1	100.0%	
6	32	Northwestern Corporation	NWE	West[3]	BBB	Baa2	100.0%	
	33	PG&E Corp.	PCG	West[3]	BB-	Ba2	100.0%	Lacks credit ratings
7	34	Pinnacle West Capital Corp	PNW	West[3]	BBB+	Baa1	88.2%	
	35	PNM Resources Inc	PNM	West[3]	BBB	Baa3	60.9%	Regulated revenue below 70% and M&A activity
8	36	Portland General Electric Co.	POR	West[3]	BBB+	A3	86.3%	
9	37	Sempra Energy	SRE	West[3]	BBB+	Baa2	87.6%	
10	38	Xcel Energy Inc	XEL	West[3]	A-	Baa1	99.3%	
				Water Utility, February 3, 2023				
1	39	American States Water Co	AWR	Water[4]	A+	NR	77.4%	
2	40	American Water Works	AWK	Water[4]	A	Baa1	92.4%	
	41	Artesian Resources Corp.	ARTNA	Water[4]	NR	NR	90.8%	Lacks credit ratings
3	42	California Water Service Group [5]	CWT	Water[4]	A+	NR	97.5%	
	43	Consolidated Water	CWCO	Water[4]	NR	NR	62.6%	Lacks credit ratings and lack dividend forecasts from Value Line
4	44	Essential Utilities	WTRG	Water[4]	A	Baa2	97.3%	
	45	Global Water Resources Inc	GWRS	Water[4]	NR	NR	100.0%	Lacks credit ratings
5	46	Middlesex Water Co	MSEX	Water[4]	A	NR	93.0%	
6	47	SJW Group	SJW	Water[4]	A-	NR	97.1%	
	48	York Water Company	YORW	Water[4]	A-	NR	98.1%	Lacks dividend forecasts from Value Line
		Average					92.38%	

	Proxy Group	Source
34	Electric & Water - 34 companies	

[1] Applied subsidiary credit rating
[2] Electric Central Utilities
[3] Electric West Utilities
[4] Water Utilities
[5] Applied subsidiary credit rating
[6] Credit Ratings, as of March 28, 2023

Staff's 2023 Proxy Group

Total No.	Company Name	Ticker	Industry	2022 S&P Credit Ratings [6]	2022 Moody's Credit Ratings [6]	2022 % Utility Revenue
			Electric Utility (East), February 3, 2023			
1	Consolidated Edison Inc	ED	East[1]	A-	Baa2	93.5%
2	Dominion Energy	D	East[1]	BBB+	Baa2	83.9%
3	Duke Energy Corp New	DUK	East[1]	BBB+	Baa2	99.0%
4	Eversource Energy	ES	East[1]	A-	Baa1	100.0%
5	NextEra Energy Inc	NEE	East[1]	A-	Baa1	82.5%
6	PPL Corp.	PPL	East[1]	BBB+	Baa2	99.2%
7	Public Service Enterprise Group Inc	PEG	East[1]	BBB+	Baa2	75.9%
8	Southern Co	SO	East[1]	BBB+	Baa2	80.0%
			Electric Util. (Central), February 3, 2023			
9	Allete Inc	ALE	Central[2]	BBB	Baa1	80.2%
10	Alliant Energy Corp	LNT	Central[2]	A-	Baa2	97.8%
11	Ameren Corp	AEE	Central[2]	BBB+	Baa1	100.0%
12	American Electric Power Co. Inc	AEP	Central[2]	A-	Baa2	86.5%
13	CenterPoint Energy Inc	CNP	Central[2]	BBB+	Baa2	96.7%
14	CMS Energy Corp	CMS	Central[2]	BBB+	Baa2	94.8%
15	Entergy Corp	ETR	Central[2]	BBB+	Baa2	97.5%
16	Evergy Inc.	EVRG	Central[2]	A-	Baa2	80.4%
17	OGE Energy Corp	OGE	Central[2]	BBB+	Baa1	97.9%
18	WEC Energy Group	WEC	Central[2]	A-	Baa1	98.2%
			Electric Utility (West), February 3, 2023			
19	Avista Corp	AVA	West[3]	BBB	Baa2	100.0%
20	Black Hills Corp	BKH	West[3]	BBB+	Baa2	95.5%
21	Edison International	EIX	West[3]	BBB	Baa2	99.7%
22	Hawaiian Electric Industries Inc [5]	HE	West[3]	BBB-	Baa1	91.1%
23	IDACORP Inc	IDA	West[3]	BBB	Baa1	100.0%
24	Northwestern Corporation	NWE	West[3]	BBB	Baa2	100.0%
25	Pinnacle West Capital Corp	PNW	West[3]	BBB+	Baa1	88.2%
26	Portland General Electric Co.	POR	West[3]	BBB+	A3	86.3%
27	Sempra Energy	SRE	West[3]	BBB+	Baa2	87.6%
28	Xcel Energy Inc	XEL	West[3]	A-	Baa1	99.3%
			Water Utility, February 3, 2023			
29	American States Water Co	AWR	Water[4]	A+	NR	77.4%
30	American Water Works	AWK	Water[4]	A	Baa1	92.4%
31	California Water Service Group [5]	CWT	Water[4]	A+	NR	97.5%
32	Essential Utilities	WTRG	Water[4]	A	Baa2	97.3%
33	Middlesex Water Co	MSEX	Water[4]	A	NR	93.0%
34	SJW Group	SJW	Water[4]	A-	NR	97.1%
					Average	92.54%

Proxy Group
Electric & Water - 34 companies

	Source
1	Applied subsidiary credit rating
2	Electric Central Utilities
3	Electric West Utilities
4	Water Utilities
5	Applied subsidiary credit rating
6	Credit Ratings, as of March 28, 2023

Staff's 2023 Proxy Group Universe

No. Selected	Total No.	Company Name	Ticker	Industry	2022 S&P Credit Ratings [6]	2022 Moody's Credit Ratings [6]	2022 % Utility Revenue	Reason for Exclusion
				Electric Utility (East), February 3, 2023				
	1	AVANGRID Inc.	AGR	East1	BBB+	Baa2	82.6%	M&A Activity
1	2	Consolidated Edison Inc	ED	East[1]	A-	Baa2	93.5%	
2	3	Dominion Energy	D	East[1]	BBB+	Baa2	83.9%	
3	4	Duke Energy Corp New	DUK	East[1]	BBB+	Baa2	99.0%	
4	5	Eversource Energy	ES	East[1]	A-	Baa1	100.0%	
	6	Exelon Corp	EXC	East[1]	BBB+	Baa2	99.2%	Lacks beta from Value Line
	7	FirstEnergy Corp	FE	East[1]	BBB-	Ba1	99.1%	Lacks credit rating
5	8	NextEra Energy Inc	NEE	East[1]	A-	Baa1	82.5%	
6	9	PPL Corp.	PPL	East[1]	A-	Baa1	99.7%	
7	10	Public Service Enterprise Group Inc	PEG	East[1]	BBB+	Baa2	75.9%	
8	11	Southern Co	SO	East[1]	BBB+	Baa2	80.0%	
	12	Unitil Corp	UTL	East[1]	BBB+	Baa2	100.0%	Lacks dividend forecasts from Value Line
				Electric Util. (Central), February 3, 2023				
1	13	Allete Inc	ALE	Central[2]	BBB	Baa1	80.2%	
2	14	Alliant Energy Corp	LNT	Central[2]	A-	Baa2	97.8%	
3	15	Ameren Corp	AEE	Central[2]	BBB+	Baa1	100.0%	
4	16	American Electric Power Co. Inc	AEP	Central[2]	A-	Baa2	86.5%	
5	17	CenterPoint Energy Inc	CNP	Central[2]	BBB+	Baa2	96.7%	
6	18	CMS Energy Corp	CMS	Central[2]	BBB+	Baa2	94.8%	
	19	DTE Energy Company	DTE	Central[2]	BBB+	Baa2	42.9%	Regulated revenue below 70%
7	20	Entergy Corp	ETR	Central[2]	BBB+	Baa2	97.5%	
8	21	Evergy Inc.	EVRG	Central[2]	A-	Baa2	80.4%	
	22	Fortis Inc	FTS	Central[2]	A-	Baa3	98.6%	Foreign exchange risk
	23	MGE Energy Inc [5]	MGEE	Central[2]	AA-	A1	100.0%	Lacks dividend forecasts from Value Line
9	24	OGE Energy Corp	OGE	Central[2]	BBB+	Baa1	97.9%	
	25	Otter Tail Corp	OTTR	Central[2]	BBB	Baa2	37.6%	Regulated revenue below 70%
10	26	WEC Energy Group	WEC	Central[2]	A-	Baa1	98.2%	
				Electric Utility (West), February 3, 2023				
1	27	Avista Corp	AVA	West[3]	BBB	Baa2	100.0%	
2	28	Black Hills Corp	BKH	West[3]	BBB+	Baa2	95.5%	
3	29	Edison International	EIX	West[3]	BBB	Baa2	99.7%	
4	30	Hawaiian Electric Industries Inc [5]	HE	West[3]	BBB-	Baa1	91.1%	
5	31	IDACORP Inc	IDA	West[3]	BBB	Baa1	100.0%	
6	32	Northwestern Corporation	NWE	West[3]	BBB	Baa2	100.0%	
	33	PG&E Corp.	PCG	West[3]	BB-	Ba2	100.0%	Lacks credit ratings
7	34	Pinnacle West Capital Corp	PNW	West[3]	BBB+	Baa1	88.2%	
	35	PNM Resources Inc	PNM	West[3]	BBB	Baa3	60.9%	Regulated revenue below 70% and M&A activity
8	36	Portland General Electric Co.	POR	West[3]	BBB+	A3	86.3%	
9	37	Sempra Energy	SRE	West[3]	BBB+	Baa2	87.6%	
10	38	Xcel Energy Inc	XEL	West[3]	A-	Baa1	99.3%	
				Water Utility, February 3, 2023				
1	39	American States Water Co	AWR	Water[4]	A+	NR	77.4%	
2	40	American Water Works	AWK	Water[4]	A	Baa1	92.4%	
	41	Artesian Resources Corp.	ARTNA	Water[4]	NR	NR	90.8%	Lacks credit ratings
3	42	California Water Service Group [5]	CWT	Water[4]	A+	NR	97.5%	
	43	Consolidated Water	CWCO	Water[4]	NR	NR	62.6%	Lacks credit ratings and lack dividend forecasts from Value Line
4	44	Essential Utilities	WTRG	Water[4]	A	Baa2	97.3%	
	45	Global Water Resources Inc	GWRS	Water[4]	NR	NR	100.0%	Lacks credit ratings
5	46	Middlesex Water Co	MSEX	Water[4]	A	NR	93.0%	
6	47	SJW Group	SJW	Water[4]	A-	NR	97.1%	
	48	York Water Company	YORW	Water[4]	A-	NR	98.1%	Lacks dividend forecasts from Value Line

	Proxy Group
34	Electric & Water - 34 companies

	Source
1	Applied subsidiary credit rating
2	Electric Central Utilities
3	Electric West Utilities
4	Water Utilities
5	Applied subsidiary credit rating
6	Credit Ratings, as of March 28, 2023

Annual Energy Outlook 2023

with projections to 2050

Annual Energy Outlook 2023 Release at Resources for the Future

Joseph DeCarolis, EIA Administrator
Angelina LaRose, Assistant Administrator for Energy Analysis

U.S. Energy Information Administration

#AEO2023

What does EIA do?

The U.S. Energy Information Administration (EIA) is the statistical and analytical agency within the U.S. Department of Energy.

EIA is the nation's premier source of energy information.

By law, our data, analyses, and forecasts are independent of approval by any other officer or employee of the U.S. government.

Our *Annual Energy Outlook* 2023 explores long-term energy trends in the United States.

What's new in the 2023 *Annual Energy Outlook*?

1

The electricity mix in the United States shifts from fossil fuels to renewables

In this section, we cover the displacement of fossil fuels by renewables in the electric power sector and explore the effects on natural gas consumption.

Renewables displace fossil fuels in the electric power sector due to declining renewable technology costs and subsidies for renewable power

Economic growth paired with increasing electrification of the end-use sectors results in stable growth in U.S. electric power demand through 2050 in all cases. Declining capital costs for solar panels, wind turbines, and battery storage, as well as government subsidies such as those included in the IRA, result in renewables becoming increasingly cost-effective compared to the alternatives when building out new power capacity.

Power demand is increasingly met by renewables throughout the projection period.

Power demand is increasingly met by renewables throughout the projection period (Figure 2). The share of natural gas, coal, and nuclear generation declines. Nuclear power is outcompeted by renewable power even in the Low Zero-Carbon Technology Cost (ZTC) case, which assumes more aggressive cost declines for nuclear and renewables than the Reference case. Most natural gas-fired generation comes from combined-cycled power plants as opposed to natural gas turbines. Uncertainty in natural gas prices across cases leads to various projections for the operation of combined-cycle units in the short term, but in the long term natural gas demand from the power sector stabilizes across all cases.

The AEO2023 includes cases that vary technical and economic assumptions, including combination cases that extend the bounds of uncertainty

Reference	1.9% annual GDP growth; Brent = $101 per barrel (b) in 2050
Economic Growth	Low: 1.4% annual GDP growth High: 2.3%
Oil Price	Low: Brent = $51/b in 2050 High: Brent = $190/b in 2050
Oil and Gas Supply	Low: 50% lower oil and gas resource recovery and 50% higher drilling costs relative to the Reference case High: 50% higher oil and gas resource recovery and 50% lower drilling costs relative to the Reference case
Zero-Carbon Technology Cost (electric power sector)	Low: About 40% reduction in cost by 2050 High: No reduction in costs
Combination	Combinations of Economic Growth and Zero-Carbon Technology Cost cases

AEO2023 *Issues in Focus:* Inflation Reduction Act

- Inflation Reduction Act *Issues in Focus* released today
  - No IRA case
  - High Uptake case
  - Low Uptake case
- Detailed IRA assumptions available on the AEO website

IRA-related caveats to keep in mind

- The IRA contains a complex package of incentives, many of which are challenging to model.
- We do not explicitly include certain IRA provisions in AEO2023 for three general reasons:
  - Guidance is not yet available on how a provision will be enacted or how agencies will implement it.
  - Provisions requiring significant model modifications that were not possible to implement this year.
  - Provisions that do not align with our analytic resolution, for example “energy communities.”
- *As a result, all energy system impacts of the IRA are not represented in AEO2023*.
- We have documented our modeling assumptions related to all IRA provisions, which are available with today’s AEO2023 release.
- We will refine our estimates over time as IRA implementation details become available and we update our modeling capability.

AEO2023 Highlights

- Energy-related CO_2 emissions fall across all AEO2023 cases because of increased electrification, higher equipment efficiencies, and more zero-carbon electricity generation.
- Renewable generating capacity grows in all regions of the United States in all AEO2023 cases, supported by growth in installed battery capacity.
- Technological advancements and electrification drive projected decreases in demand-side energy intensity.
- The United States remains a net exporter of petroleum products and of natural gas through 2050 in all AEO2023 cases.

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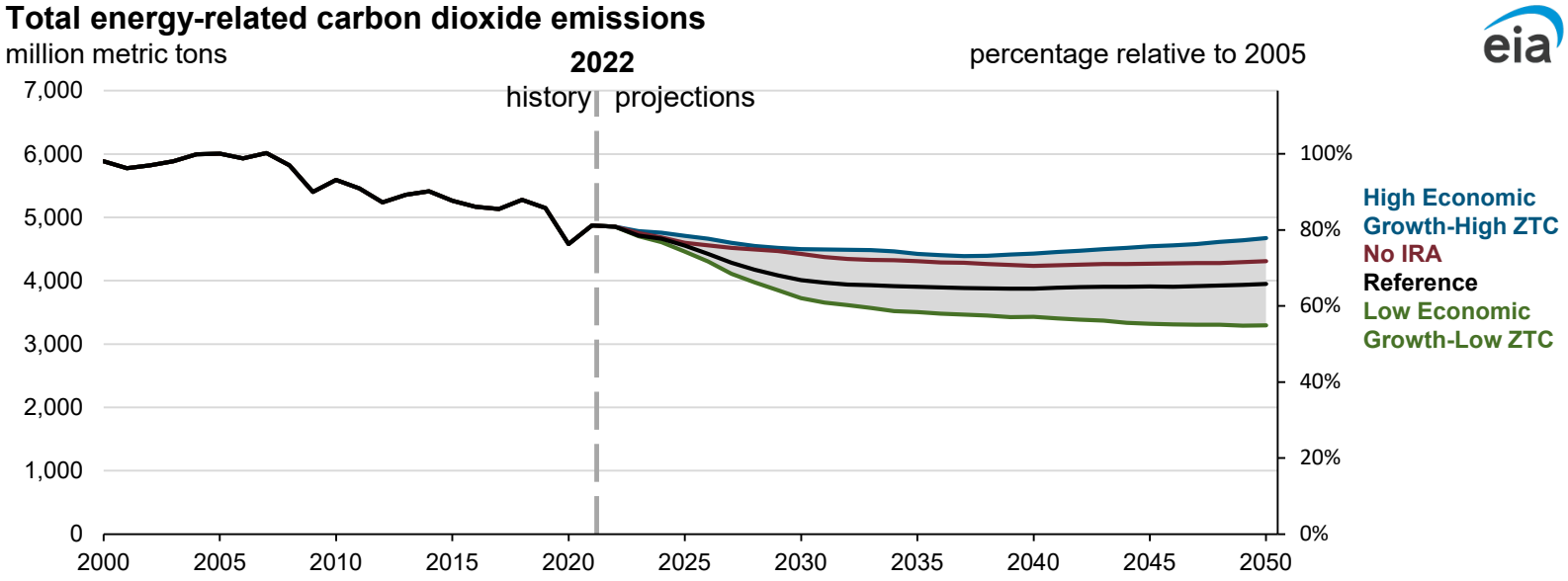
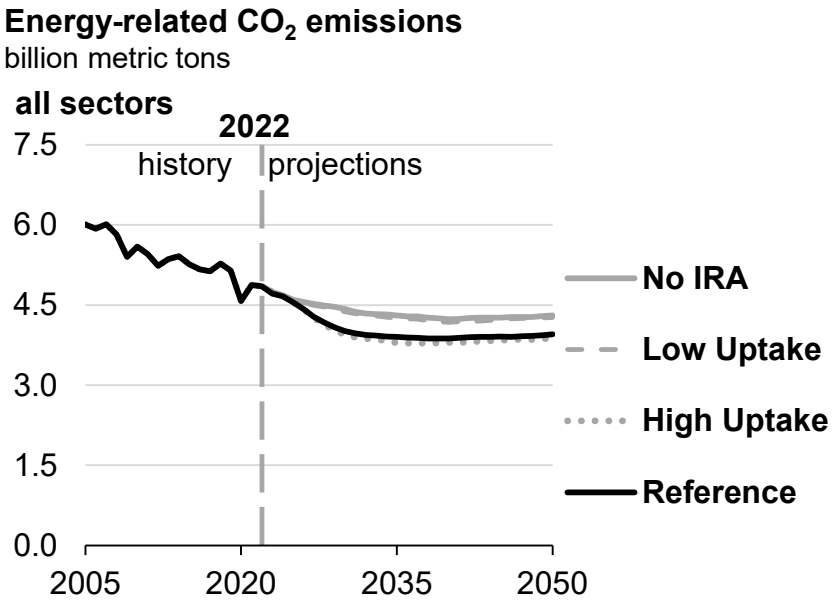
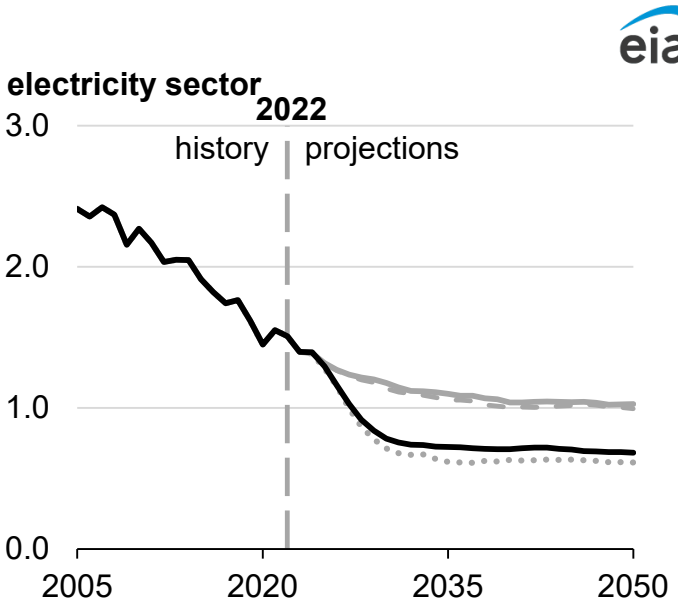
By 2030, energy-related CO_2 emissions fall 25% to 38% below 2005 levels




Energy-related CO_2 emissions
billion metric tons
all sectors
2022
history
projections
7.5
6.0
4.5
3.0
1.5
0.0
2005
2020
2035
2050
No IRA
Low Uptake
High Uptake
Reference


electricity sector
2022
history
projections
3.0
2.0
1.0
0.0
2005
2020
2035
2050

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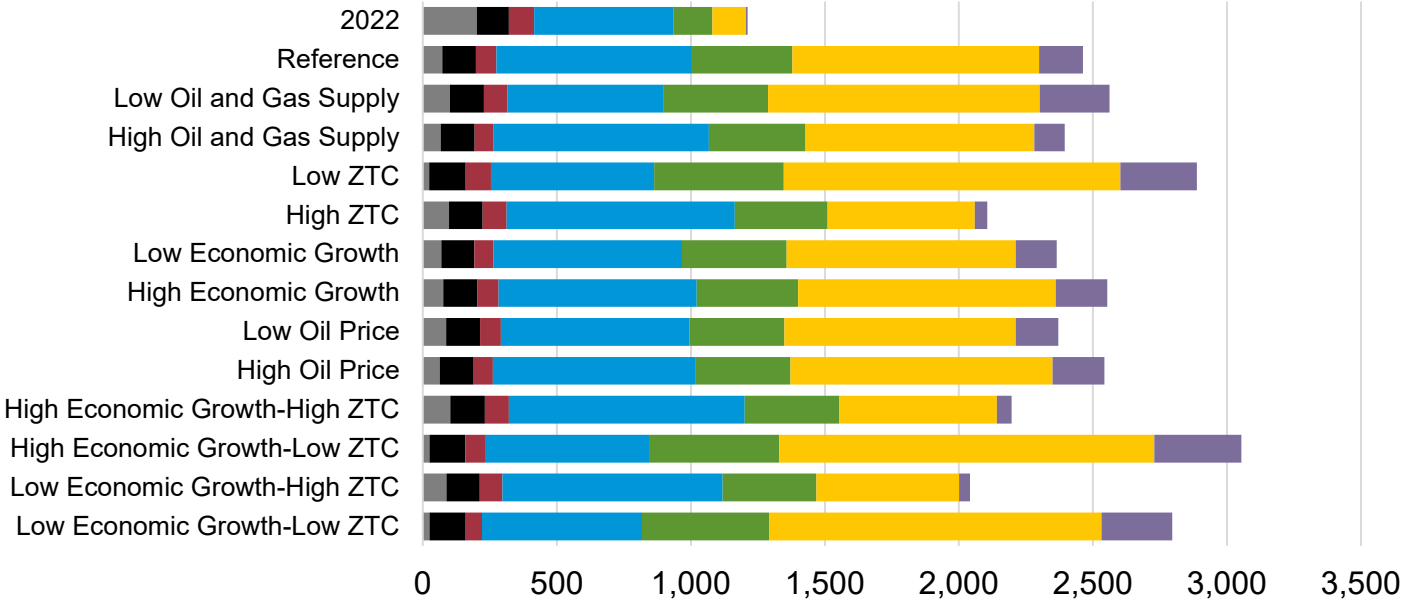
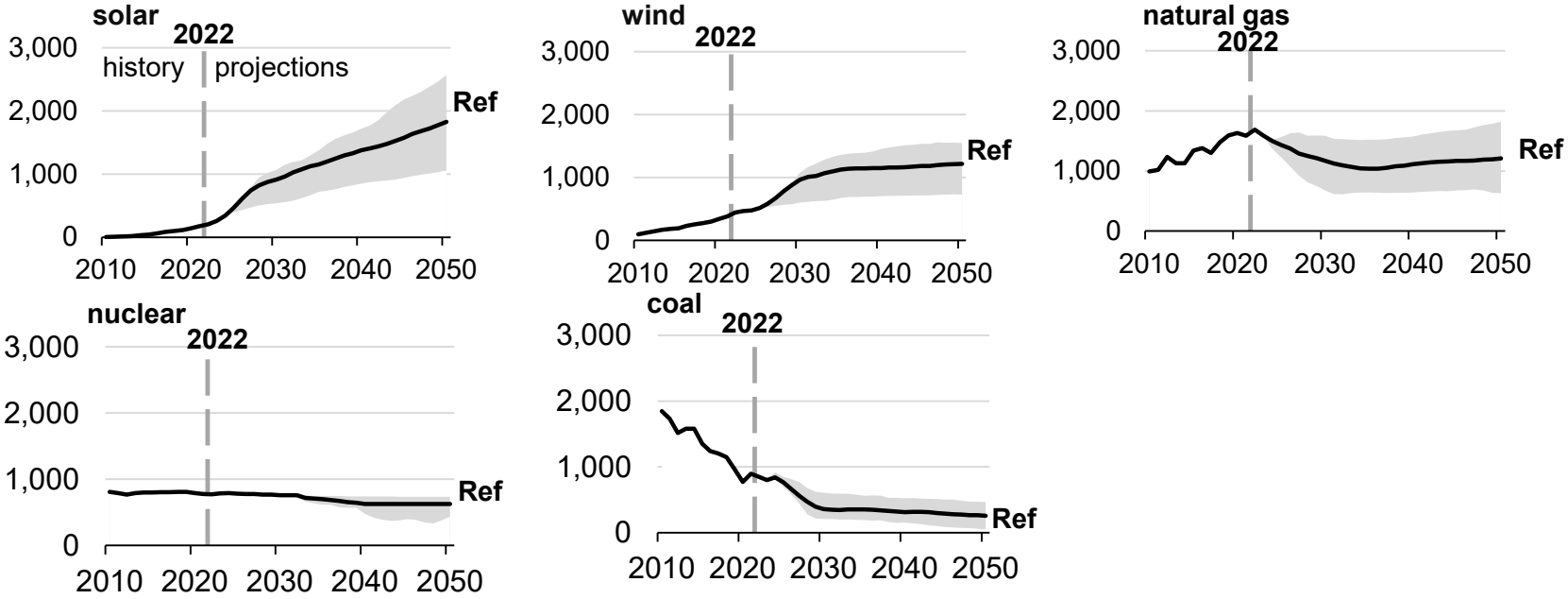
Total installed generating capacity more than doubles across most scenarios

Total installed capacity in all sectors, 2022 (history) and 2050
gigawatts

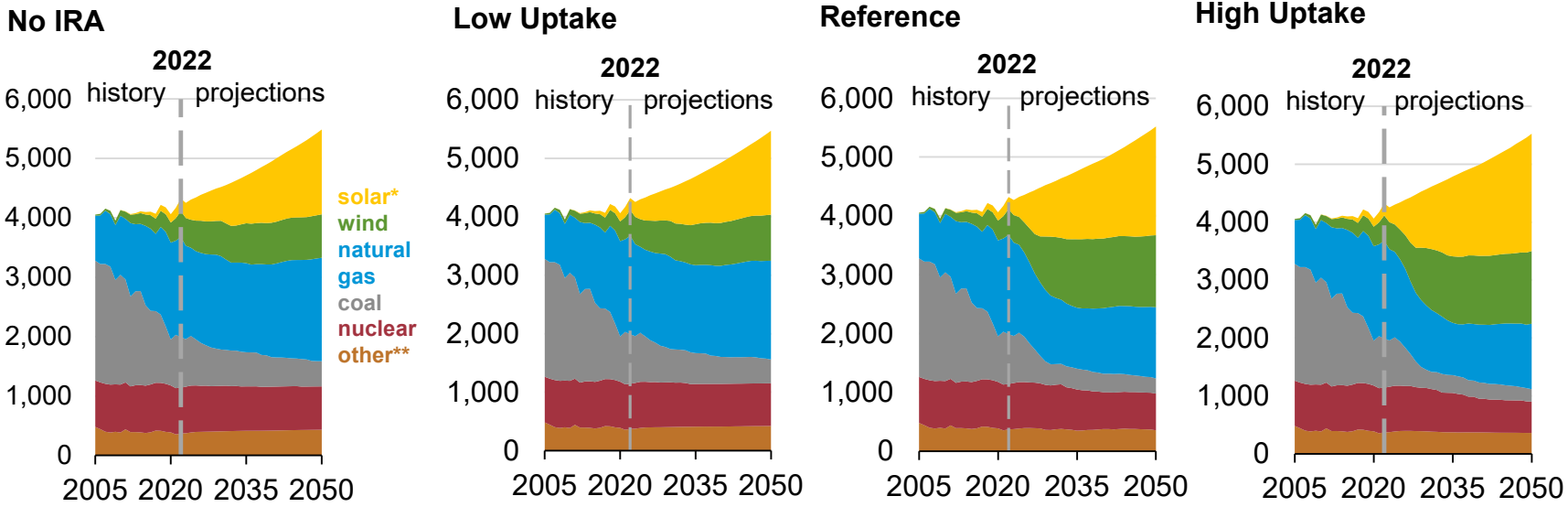


Power demand is increasingly met by renewables



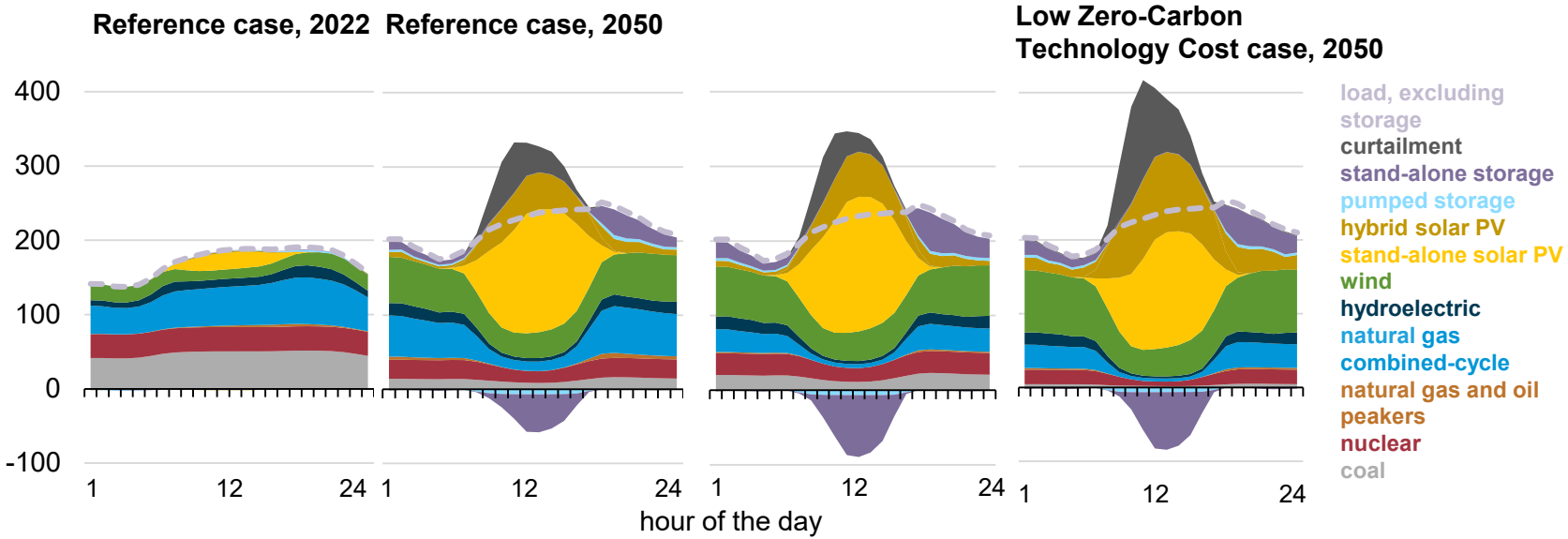
Data source: U.S. Energy Information Administration, *Annual Energy Outlook 2023* (AEO2023)
Note: Shaded regions represent maximum and minimum values for each projection year across the AEO2023 Reference case and side cases.
Ref=Reference case

Solar and wind generate a majority of U.S. electricity by 2050 in the Reference and High Uptake cases



More intermittent renewables lead to more curtailment and usage of battery storage

Hourly U.S. electricity generation and load by fuel for selected cases and representative years
billion kilowatthours



Data source: U.S. Energy Information Administration, *Annual Energy Outlook 2023* (AEO2023)
Note: Negative generation represents charging of energy storage technologies such as pumped hydro and battery storage. Hourly dispatch estimates are illustrative and are developed to determine curtailment and storage operations; final dispatch estimates are developed separately and may differ from total utilization as this figure shows. Standalone solar photovoltaic (PV) includes both utility-scale and end-use PV electricity generation.

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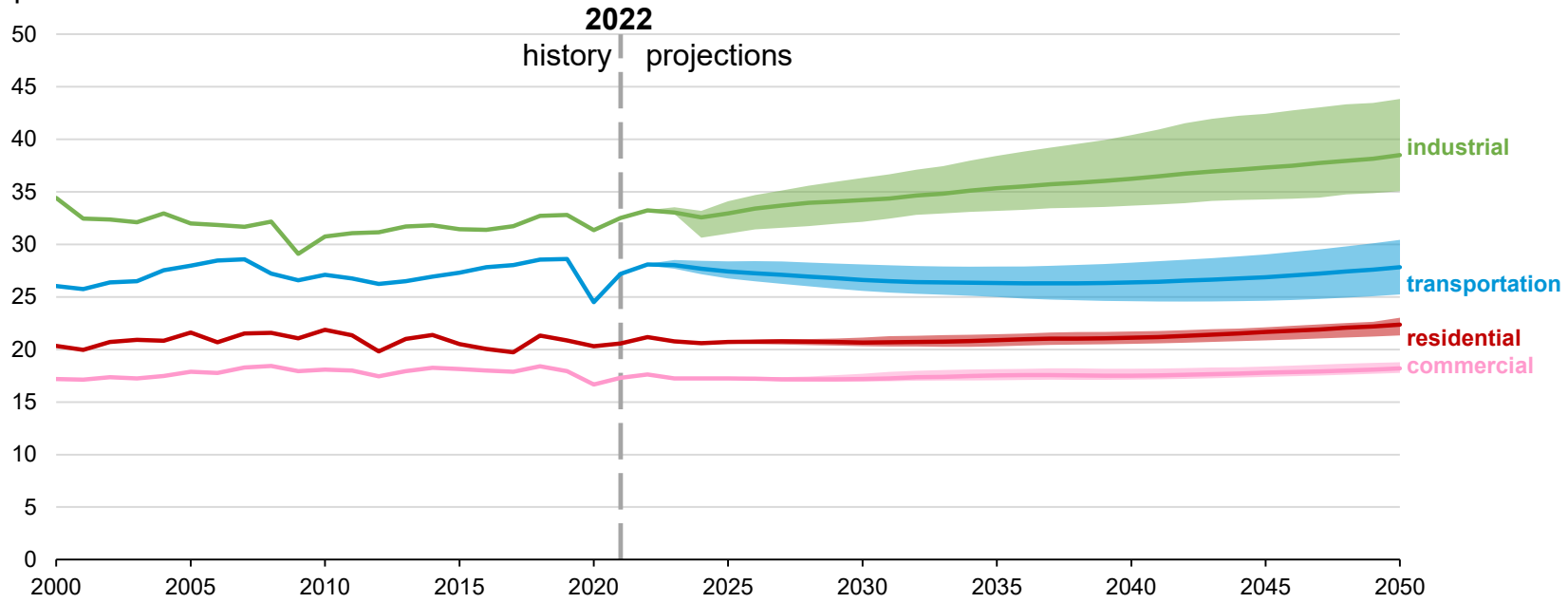
U.S. energy consumption increases to 2050, and electricity plays an increasingly larger role

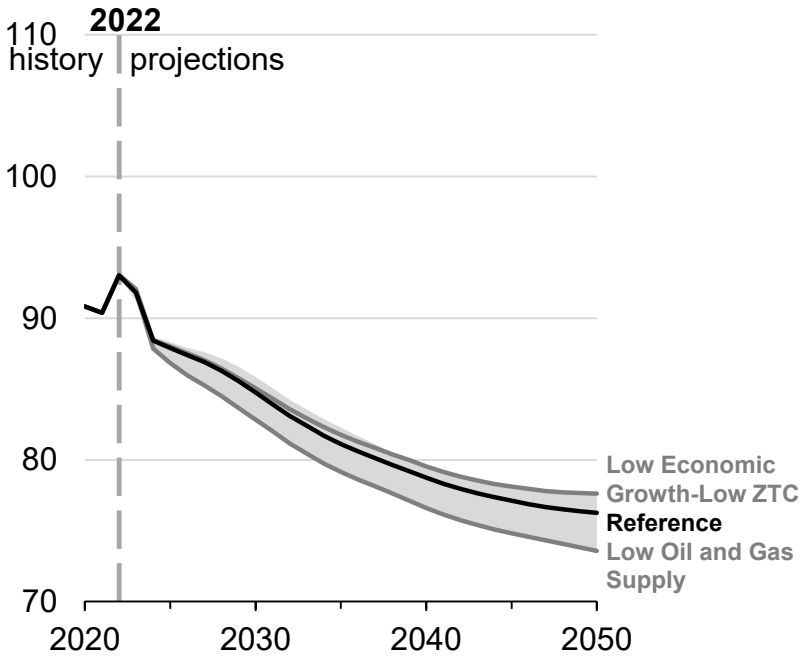
Total energy consumption by end-use sector
quadrillion British thermal units



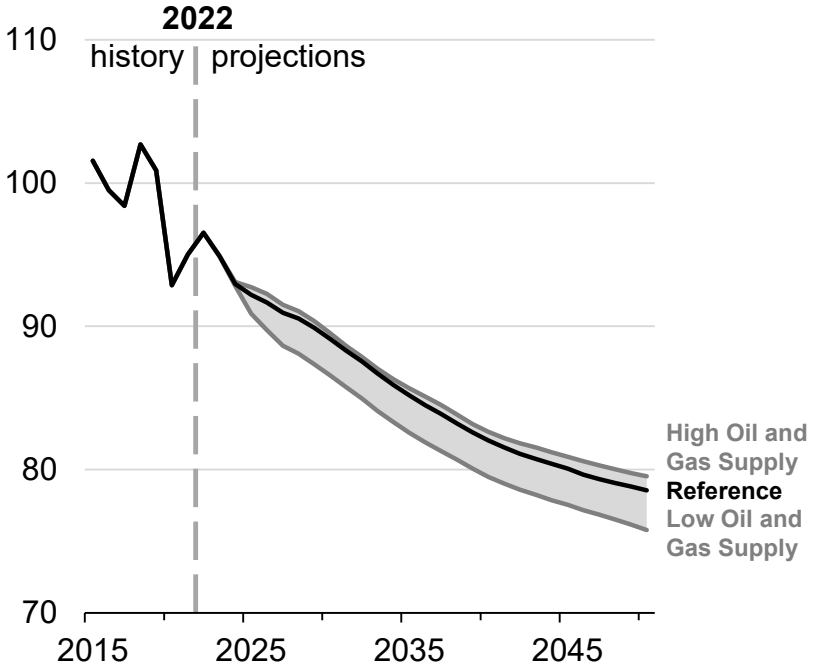
Data source: U.S. Energy Information Administration, *Annual Energy Outlook 2023* (AEO2023)
Note: Total consumption in end-use sectors includes purchased electricity and electricity-related losses. Each line represents AEO2023 Reference case projections. Shaded regions represent maximum and minimum values for each projection year across the AEO2023 Reference case and side cases.

Average energy intensity declines through 2050 across all cases

Residential delivered energy intensity
million British thermal units per household

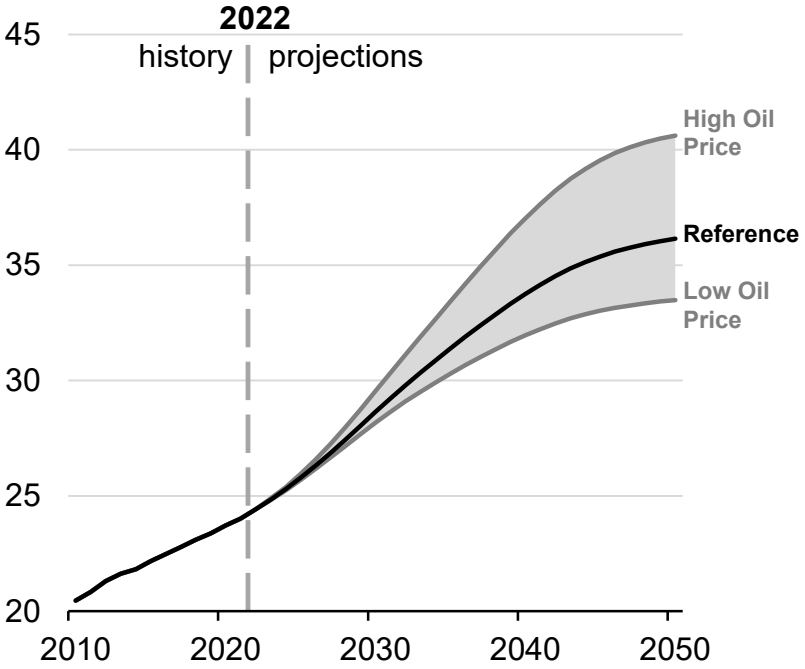


Commercial delivered energy intensity
thousand British thermal units per square foot

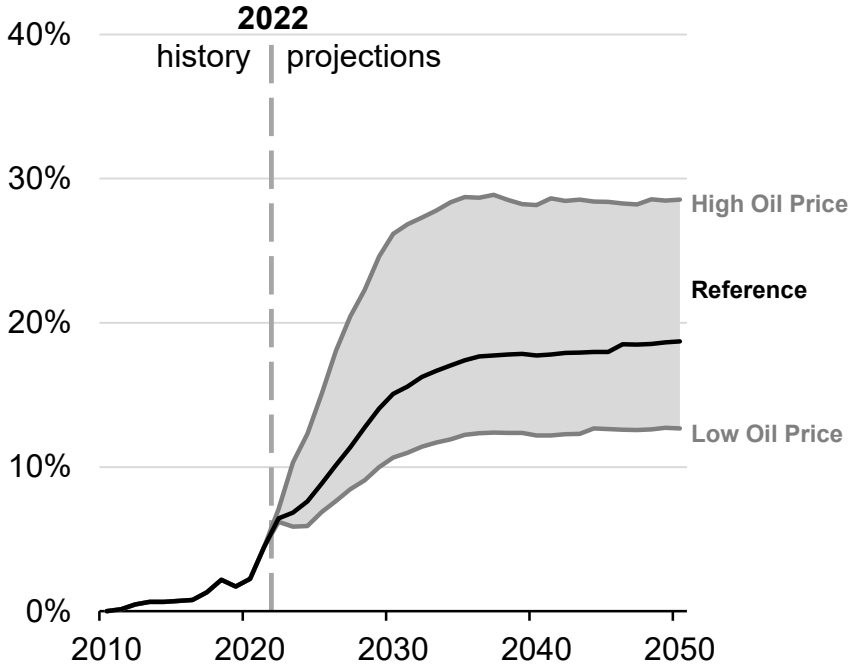


Light-duty vehicle fuel economy and electric vehicle market share increase through 2050 due to rising CAFE Standards and other incentives

Light-duty vehicle average fuel economy
miles per gallon

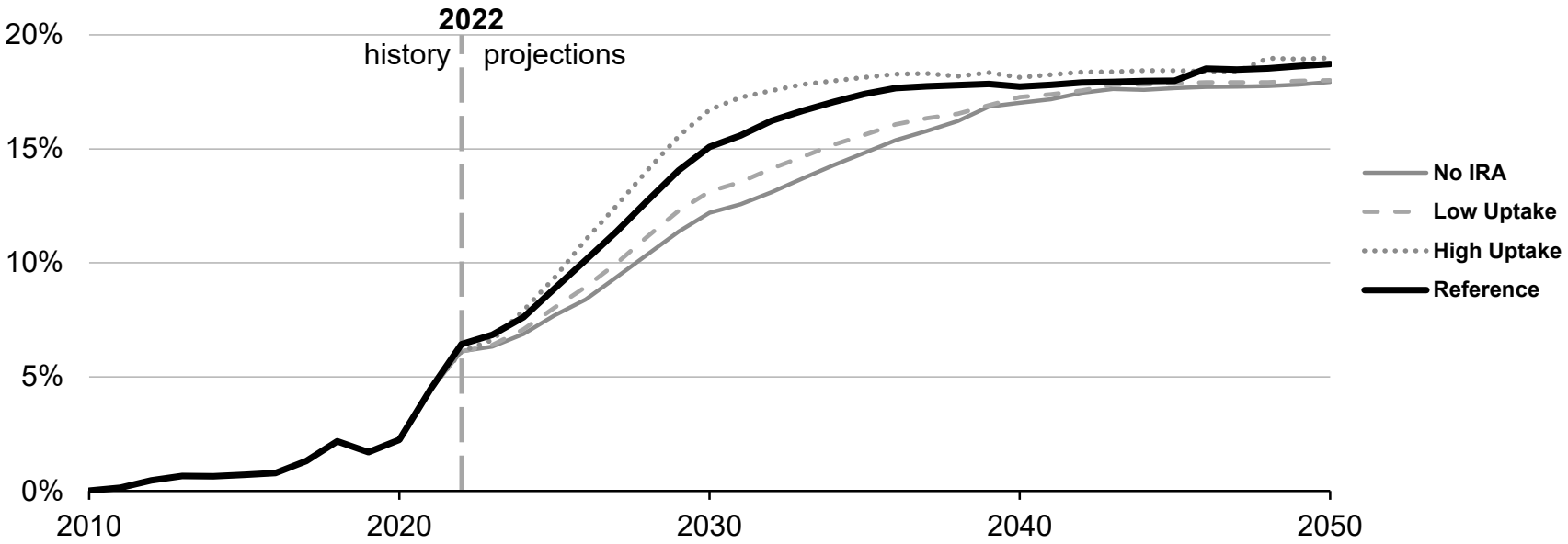


Market share of electric light-duty vehicles*
percentage of sales



IRA incentives speed growth in sales of electric vehicles

Market share of electric light-duty vehicles*
percentage



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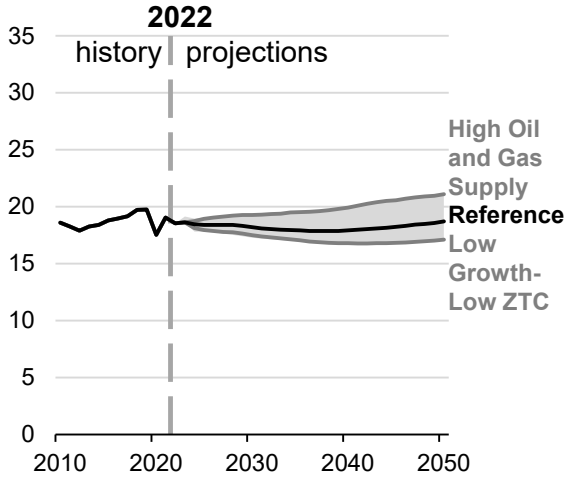
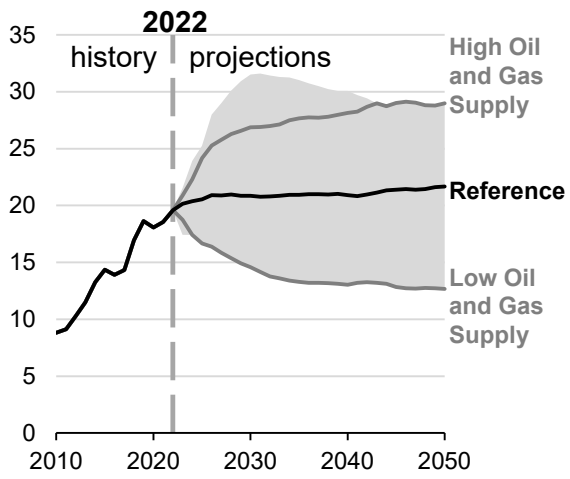
In all cases, we project that the United States will remain a net exporter of petroleum products through 2050

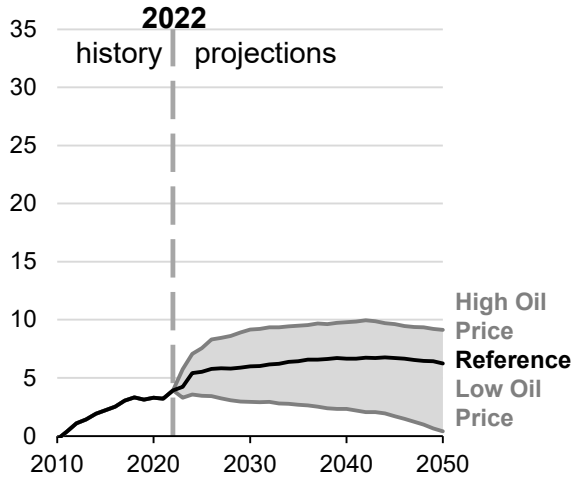
Petroleum and other liquids consumption
million barrels per day



Petroleum and other liquids production
million barrels per day

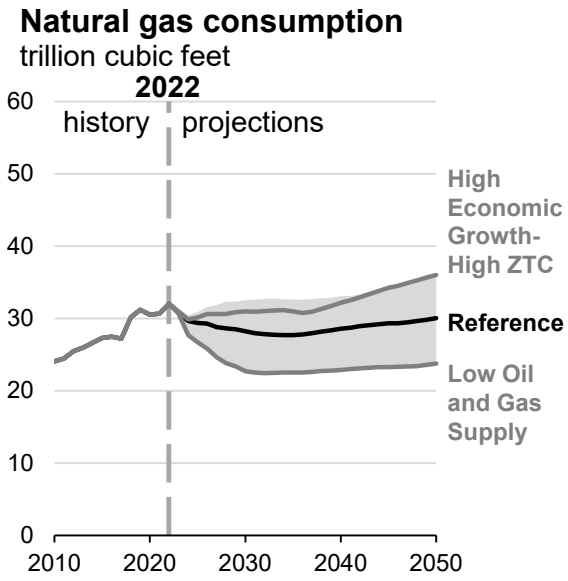


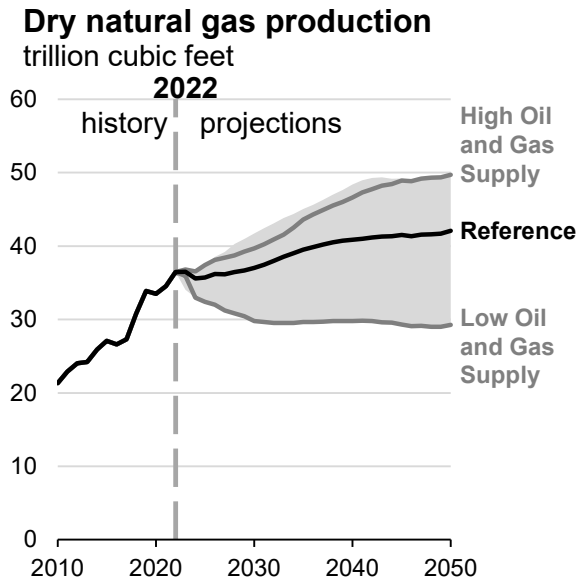
Petroleum products net exports
million barrels per day

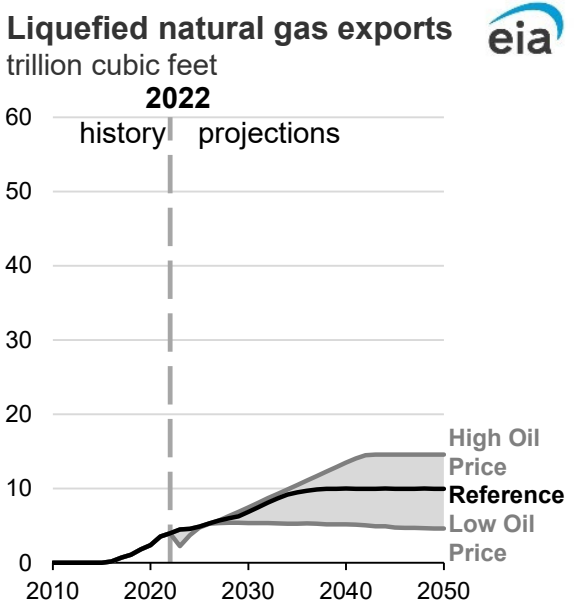


Data source: U.S. Energy Information Administration, *Annual Energy Outlook 2023* (AEO2023)
Note: Biofuels are not included in *petroleum and other liquids* production or consumption. Shaded regions represent maximum and minimum values for each projection year across the AEO2023 Reference case and side cases. ZTC=Zero-Carbon Technology Cost

Liquefied natural gas exports drive production; domestic consumption remains stable







Upcoming AEO2023 *Issues in Focus*

- Liquefied Natural Gas (LNG) *Issues in Focus* coming next month
  - High LNG Price case
  - Low LNG Price case
  - Fast Builds + High LNG Price case

Independent Statistics and Analysis

U.S. Energy Information Administration

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Quantitative Profiles

Whipsaw alert: style and sector risks are heightened

Winner: Return on Equity +16.3%

Consistent with the Downturn phase of our US regime model, quality factors have led across style categories this year (+8.5% on avg.) with our long-term, leverage adjusted quality screen ranking #1 (5-yr Deb Adjusted ROE). Value has lagged YTD, but cash flow-based value and DDM styles have held up better than "deep value" factors like Price to Book. Growth factors were mixed (and have generally been mixed during Downturns) - Long Duration stocks made our top 5, but EPS and Price Momentum lagged.

Surprise bout of QE explains growth stock comeback

At an index level, the Russell 1000 Growth handily outperformed Value, but the spread is largely attributable to Fed balance sheet expansion of more than 7ppt (annualized) in 1Q. Since the financial crisis, the spread between Russell Growth and Russell Value benchmarks has been strongly correlated with Fed balance sheet expansion/contraction (ρ= 50%). This suggests that unless the Fed continues to expand its balance sheet, growth stock leadership may be at risk of waning rather than waxing.

Luxury is now high beta (plus other sector surprises)

Factors reveal somewhat counterintuitive risks: high income retailers have historically been considered defensive vs. lower income retailers, but today's basket of US high income retailers carries almost 2x the beta of low income's (1.3 vs. 0.7). Moreover, the high income basket is 40% overweight by active funds vs. low income's 30% underweight. Meanwhile our economists cite high income households significantly lagging lower income ones (see BofA on USA). Beta risks across other sectors also point to surprising shifts –old economy cyclicals like Energy, Industrials and Financials have seen betas drop whereas Real Estate, Tech and Utilities betas increased.

Elevated whipsaw risk amid noncommittal macro trends

Our US regime indicator dipped further into a Downturn (from -0.3 to-0.5), but of the eight inputs, five improved from last month (Exhibit 6). Just a 6% increase across the inputs would result in a flip to an Upturn. This shift is often the most painful for investors given the extreme reversals in leadership of risk (low to high), size (large to small), style (quality value to deep value) and quality (high quality to distress). Energy, Financials and Discretionary would likely rally the most (and are quite underweight).

Watch buybacks as tighter credit begets scarcity alpha

Buybacks enjoyed strong YTD outperformance, perhaps ahead of a slowdown. The historical average alpha of buybacks has been all but flat (~1ppt) but has increased as buybacks decelerate during prior market cycles. And tightening credit is more likely to impact buybacks and tech capex than dividends and traditional capex. Note that for every dollar borrowed or earned by corporations, almost 28c is spent on buybacks vs, 7c in 1990. Tech capex increased to 30c over the same period, with software spend tripling. Dividends, traditional capex and other sources of cash have shrunk, and the dividend payout ratio sits at almost a century low.

Download stock lists and historical factor returns in Excel: Research Library

16 May 2023

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Exhibit 1:Best and worst performing screens YTD
As of 4/30/2023

Top 5/Bottom 5 screens

Top 5 screens	Perf.
ROE (5-Yr Avg. Adj. by Debt)	16.3%
Institutional Neglect	8.8%
ROE (1-Yr Avg. Adj. by Debt)	8.5%
Long Duration	7.8%
ROA	7.5%
S&P 500 (Equal weighted)	**2.8%**

Bottom 5 screens	Perf.
Forward Earnings Yield	-8.5%
Earnings Yield	-7.6%
Low Price to Book Value	-5.7%
Low Price	-3.4%
Price Returns (9-Month)	-2.2%
S&P 500 (Equal weighted)	**2.8%**

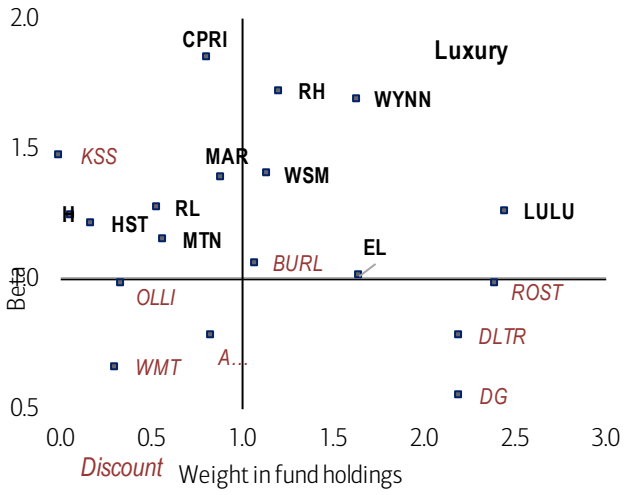
Source: FactSet, BofA US Equity & Quant Strategy

BofA GLOBAL RESEARCH

Contents

Spotlight: what's really defensive?

Exhibit 2: High income retailers have higher beta and more positioning risk than low income retailers
Discount basket and Luxury basket – Beta and positioning



Source: BofA US Equity & US Quant Strategy, FactSet Ownership

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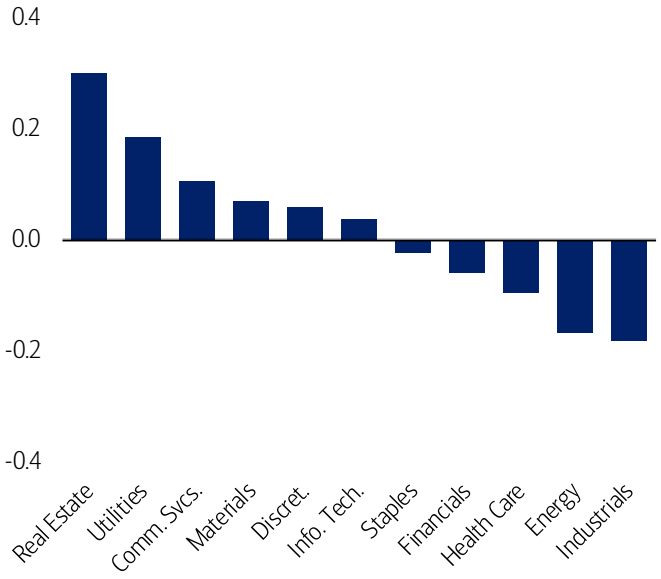
Exhibit 3: TMT & Defensives riskier, Old economy cyclicals safer??
3-yr Betas as of 4/23 vs 3-yr Betas as of 12/19



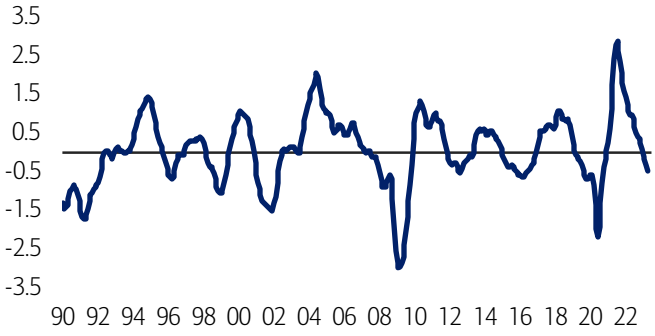
Source: BofA US Equity & US Quant Strategy

BofA GLOBAL RESEARCH

US Regime model

Deeper into a downturn, but whipsaw risks are high

Exhibit 4: US Regime Indicator moved further into Downturn
The US Regime indicator (Jan. 1990-April 2023)



Source: BofA US Equity & Quant Strategy, Refinitiv, ICE Data Indices, LLC, Institute for Supply Management, Bureau of Labor Statistics, Federal Reserve
Note: Phase 1 – Early Cycle; Phase 2 – Mid Cycle; Phase 3 – Late Cycle; Phase 4 – Recession
Disclaimer: The indicator identified as the US Regime Indicator above is intended to be an indicative metric only and may not be used for reference purposes or as a measure of performance for any financial instrument or contract, or otherwise be relied upon by third parties for any other purpose, without the written consent of BofA Global Research. This indicator was not created to act as a benchmark.

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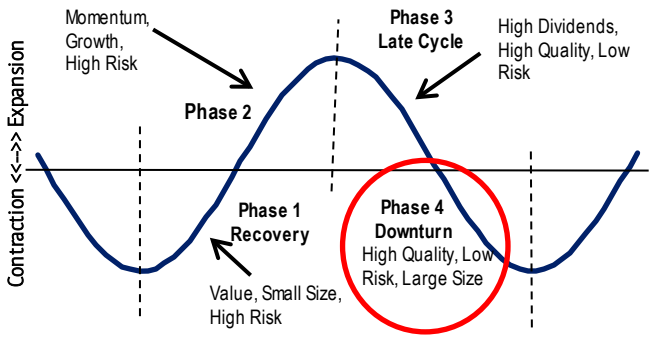
Exhibit 5: US Regimes – a heuristic
High Quality, Low Risk and Large Size tend to fare well in Downturn



Source: BofA US Equity & US Quant Strategy

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Exhibit 6: Five of eight inputs based on raw levels improved from last month
US Regime indicator inputs

	Z-Score summary				Raw Level summary				Description
	Z-Score based on:	Z-Score Latest	Z-Score Prev.	1m chg (+/-)	Current Level	Prev Month	1m chg (+/-)	L-T Avg	Description
EPS Revisions Ratio	level	-0.25	-0.50	+	0.8	0.7	+	0.9	% of companies with improving EPS forecasts vs 3-mth ago vs the ones with declining forecasts
Inflation composite	y/y	-0.92	-0.16	-	461.1	463.5	-	289.6	BofA composite based on CPI, PPI, Commodity prices and wage inflation
CPI					4.9	5.0	-	2.8	Consumer Price Index
PPI					2.6	3.0	-	2.5	Producer Price Index
Commodities (y/y)					-13.0	-9.3	-	5.2	Commodities Prices
AHE (y/y)					5.0	5.1	-	3.2	Hourly wages
GDP Forecast	level	-1.38	-1.42	+	1.0%	1.0%	+	2.5%	US GDP Economic Forecast
10-yr US Treasury Yield	y/y	0.38	1.26	-	3.42	3.47	-	4.23	General level of interest rates in the economy
ISM Manufacturing PMI	level	-1.13	-1.30	+	47.1	46.3	+	52.5	Tracks the general state of the economy as it relates to businesses.
Leading Econ. Indicators	y/y	-1.74	-1.55	-	108.4	109.7	-	91.0	Leading indicators give a sense of the future state of an economy.
Capacity Utilization	y/y	-0.25	-0.13	-	79.8	79.6	+	78.7	Tracks the utilization of the installed productive capacity in the production of goods and services
High Yield credit spread	-1*y/y	-0.05	-0.44	+	453.0	458.0	+	539.9	Indicates the level of financial stress in the bond market

Source: BofA US Equity & Quant Strategy, Refinitiv, ICE Data Indices, LLC, Institute for Supply anagement, Bureau of Labor Statistics, Federal Reserve

BofA GLOBAL RESEARCH

US Regime Indicator as a tool for factor investing

Factor behavior has been relatively well behaved during different phases of the US Regime cycle. High Quality and Large Cap tend to outperform during the "Downturn" phase of the cycle, whereas Value, High Risk and Small Caps tend to outperform during the "Recovery" phase.

Exhibit 7: Style performance in the four US Regime indicator phases
Relative performance vs. equal-weighted S&P 500

		Value	Growth	Momentum	High Quality	Low Quality	High Risk	Low Risk	Large Cap	Small Cap	Low Beta	High Div. Yield
Phase 1	Avg:	19.4%	-7.5%	-5.9%	-6.0%	8.4%	18.4%	-10.7%	-8.4%	19.0%	-12.8%	7.0%
Recovery	Median:	14.9%	-5.3%	-1.7%	-6.5%	10.7%	12.9%	-12.5%	-7.8%	11.2%	-13.4%	7.8%
	Hit Rate:	100.0%	12.5%	50.0%	25.0%	75.0%	75.0%	25.0%	12.5%	75.0%	12.5%	87.5%
Phase 2	Avg:	3.8%	10.9%	11.2%	0.8%	3.9%	11.0%	-6.6%	-2.1%	6.0%	-12.6%	-6.7%
Mid Cycle	Median:	4.3%	2.3%	4.0%	-0.7%	2.2%	10.3%	-4.9%	-6.6%	9.1%	-12.1%	-7.1%
	Hit Rate:	77.8%	66.7%	77.8%	44.4%	66.7%	77.8%	22.2%	33.3%	77.8%	0.0%	11.1%
Hit Rate ex. Tech Bubble:		*87.5%*	*62.5%*	*75.0%*	*37.5%*	*75.0%*	*75.0%*	*25.0%*	*25.0%*	*87.5%*	*0.0%*	*12.5%*
Phase 3	Avg:	-0.8%	-6.2%	-3.4%	3.5%	-6.9%	-11.4%	8.4%	-1.2%	-7.6%	7.0%	7.5%
Late Cycle	Median:	-0.9%	-1.8%	2.3%	5.8%	-6.6%	-8.9%	9.8%	2.3%	-8.1%	3.2%	3.5%
	Hit Rate:	44.4%	33.3%	55.6%	66.7%	22.2%	11.1%	77.8%	55.6%	11.1%	55.6%	77.8%
Phase 4	Avg:	-0.8%	-0.2%	3.1%	5.2%	-4.7%	-6.1%	4.8%	5.6%	-3.0%	-0.9%	-2.4%
Downturn	Median:	-6.3%	0.4%	0.9%	3.7%	0.0%	-4.5%	4.3%	6.5%	-7.5%	0.9%	-5.9%
(Current)	Hit Rate:	28.6%	57.1%	57.1%	71.4%	28.6%	42.9%	85.7%	85.7%	14.3%	57.1%	28.6%

Note: Performance is calculated as price return relative to equal-weighted S&P 500, for all styles except High Dividend Yield, where total return for the style and the index are used. Hit rate = % of months in phase where style outperformed equal-weighted S&P 500 and based on the January 1990 – present time period.
Source: BofA US Equity & Quant Strategy, Refinitiv, ICE Data Indices, LLC, Institute for Supply Management, Bureau of Labor Statistics, Federal Reserve

BofA GLOBAL RESEARCH

Inputs for the US Regime Indicator include the following eight macroeconomic or top-down variables:

- **Earnings Revision ratio:** Calculated as the ratio between the number of companies in the S&P 500 for which Thomson Financial consensus earnings estimates have been raised versus those that have been lowered. A rising ratio indicates an improving economic cycle.

- **ISM PMI:** ISM PMI Institute for Supply Management Manufacturing Purchasing Managers Index, represented as the Z-Score. The ISM Manufacturing Index monitors

economic activity as reported by 300 supply management professionals. The reading of the index above (below) 50 indicated economic expansion (contraction).

- **Inflation:** The 12-month change in the BofA Inflation Composite (see methodology further below), represented as the Z-Score. Rising inflation indicates improving economic conditions.
- **GDP Forecast:** The next 12-month US GDP growth forecast from the Federal Reserve Bank of Philadelphia Survey, represented as the Z-Score.
- **Leading Economic Indicators index:** The 12-month change in the Conference Board US Leading Index of Ten Economic Indicators, represented as a Z-Score. A rising Z-Score indicates improving economic conditions.
- **US Capacity Utilization:** The 12-month change in US capacity utilization, represented as the Z-score. The capacity utilization rate indicates the percentage of total economic capacity currently utilized. Rising capacity utilization implies improving economic conditions. Rising capacity utilization suggests more expanding economic cycle and potentially rising inflationary pressure.
- **10-yr US Treasury Bond Yield:** The 12-month change in the bond yield, represented as the Z-Score. Rising yields indicate improving economic conditions.
- **High Yield corporate bond credit spread:** The 12-month change in the US High Yield credit spread of the ICE BofA US High Yield Index, represented as a Z-score. Falling spreads indicate improving economic conditions.

Exhibit 8: 12-month Price Return outperformed all other factors we follow in April
Quantitative Strategies Performance (Top Decile as of 4/30/2023)

Strategies (based on the S&P 500)		1 M	3 M	6 M	12 M	YTD	2 Yr Perf. Gross	2 Yr Perf. Anlzd	3 Yr Perf. Gross	3 Yr Perf. Anlzd	5 Yr Perf. Gross	5 Yr Perf. Anlzd	Inception Date
Price Returns (12-Month)	Technical	1.9	-1.9	-2.9	1.2	-0.2	5.1	2.5	52.6	15.1	44.0	7.6	1/31/2010
Price Returns (11-Month since 1 year ago)	Technical	1.6	-2.4	-3.1	3.8	-0.1	0.3	0.1	42.8	12.6	40.9	7.1	1/31/2010
S&P 500 Index (Price Return)	Benchmark	1.5	2.3	7.7	0.9	8.6	-0.3	-0.1	43.2	12.7	57.5	9.5	
Price Returns (12-Month plus 1-Month Reversal)	Technical	1.4	-1.3	5.3	9.4	4.3	5.2	2.5	42.7	12.6	48.7	8.3	1/31/2010
Share Repurchase	Corp Cash Deployment	1.3	-4.9	6.6	1.2	5.6	5.6	2.8	66.4	18.5	42.3	7.3	12/31/2004
Short Interest	Miscellaneous	1.3	-2.8	5.3	-0.7	3.2	-4.7	-2.4	42.3	12.5	33.3	5.9	10/31/2013
Analyst Coverage Neglect	Miscellaneous	1.3	-4.8	5.2	-0.1	4.1	-0.5	-0.3	55.0	15.7	56.5	9.4	6/30/1989
Relative Strength (30wk/75wk)	Technical	1.2	-2.4	-4.5	1.4	-1.1	-0.7	-0.3	41.1	12.2	36.1	6.4	8/31/1995
High Dividend Growth (Total Return)	Corp Cash Deployment	1.0	-5.8	2.8	5.2	1.0	16.7	8.0	76.1	20.8	66.0	10.7	12/31/2004
High Dividend Growth (Price Return)	Corp Cash Deployment	0.9	-6.6	1.2	2.0	0.1	10.9	5.3	63.6	17.8	46.6	8.0	12/31/2004
Price Returns (12-Month plus 1-Month)	Technical	0.9	0.6	0.3	-5.4	1.5	-3.4	-1.7	51.0	14.7	39.8	6.9	1/31/2010
Forecast Negative Earnings Surprise	Growth (Negative)	0.8	-7.5	1.3	-1.0	-1.6	-0.4	-0.2	52.0	15.0	38.7	6.8	12/31/1988
Dividend Yield (Total Return)	Corp Cash Deployment	0.6	-9.1	1.6	-4.0	-0.7	13.4	6.5	91.7	24.2	69.0	11.1	12/31/1988
Dividend Yield (Price Return)	Corp Cash Deployment	0.3	-10.4	-1.2	-9.1	-2.4	2.7	1.3	63.1	17.7	31.3	5.6	12/31/1988
Low PE to GROWTH	GARP	0.3	-10.0	-5.7	-3.2	-1.7	1.9	0.9	59.1	16.7	23.0	4.2	12/30/1988
S&P 500 Equal Weighted (Total Return)	Benchmark	0.2	-3.9	5.2	0.7	3.4	1.8	0.9	60.4	17.1	61.2	10.0	
Low Price to Free Cash Flow	Value	0.2	-8.5	-0.3	-9.1	-0.4	-5.8	-2.9	40.8	12.1	10.7	2.1	7/30/2003
DDM Valuation	Value	0.2	-5.8	-0.3	-0.4	3.3	0.8	0.4	32.4	9.8	5.5	1.1	12/31/1988
S&P 500 Equal Weighted (Price Return)	Benchmark	0.1	-4.4	4.1	-1.4	2.8	-2.0	-1.0	51.4	14.8	45.6	7.8	
ROE (1-Yr Average)	Quality	-0.2	-0.9	7.7	4.0	6.0	7.5	3.7	57.3	16.3	70.4	11.2	4/30/1997
ROE (5-Yr Average)	Quality	-0.3	-1.0	6.8	5.8	6.0	4.9	2.4	51.1	14.8	58.6	9.7	4/30/1997
High Free Cash Flow to EV	Value	-0.3	-8.5	-4.1	-9.4	-2.1	-10.6	-5.4	38.2	11.4	12.5	2.4	7/31/2010
Institutional Neglect	Miscellaneous	-0.3	-1.7	8.0	1.6	8.8	0.8	0.4	56.1	16.0	58.0	9.6	12/31/1988
Low EV/EBITDA	Value	-0.4	-7.3	1.5	-5.4	1.4	-0.7	-0.3	66.4	18.5	7.4	1.4	9/30/2001
ROE (5-Yr Avg. Adj. by Debt)	Quality	-0.4	5.2	18.7	8.8	16.3	1.8	0.9	57.4	16.3	78.1	12.2	4/30/1997
High Duration	Growth	-0.4	1.6	11.6	1.2	7.8	-5.5	-2.8	40.6	12.0	55.1	9.2	12/31/1988
High Projected 5-Yr Growth	Growth	-0.5	-5.2	1.3	5.1	2.9	8.0	3.9	63.7	17.9	56.3	9.3	12/31/1988
Forecast Positive Earnings Surprise	Growth	-0.6	-6.0	1.1	-3.5	0.1	-2.9	-1.5	50.6	14.6	45.8	7.8	12/31/1988
ROA	Quality	-0.6	-1.0	10.1	3.2	7.5	-1.7	-0.9	43.1	12.7	68.0	10.9	4/30/1997
Relative Strength (Price/200-Day Moving Avg)	Technical	-0.6	-0.8	0.8	1.1	3.3	2.4	1.2	71.8	19.8	62.3	10.2	1/31/2010
EPS Momentum	Growth	-0.7	-7.9	-5.4	-6.2	-1.2	-0.9	-0.4	45.3	13.3	26.2	4.8	12/31/1988
Relative Strength (10wk/40wk)	Technical	-0.8	-3.5	-2.1	1.9	0.2	-6.5	-3.3	51.2	14.8	49.8	8.4	1/31/2010
Price Returns (9-Month)	Technical	-0.8	-4.0	-6.8	-0.1	-2.2	-1.9	-1.0	53.5	15.4	56.1	9.3	1/31/2010
Low Price to Sales	Value	-1.0	-10.4	-3.4	-9.0	-1.3	-6.1	-3.1	69.2	19.2	49.7	8.4	12/31/1988
Low Price to Cash Flow	Value	-1.0	-9.0	-0.1	-8.2	1.6	-4.0	-2.0	50.4	14.6	-5.3	-1.1	12/31/1988
Small Size	Miscellaneous	-1.1	-13.6	-0.3	-10.0	-2.0	-13.4	-7.0	63.1	17.7	23.0	4.2	12/31/1988
ROE (1-Yr Avg. Adj. by Debt)	Quality	-1.2	-0.9	7.2	3.3	8.5	-4.9	-2.5	40.0	11.9	52.2	8.8	4/30/1997
ROC	Quality	-1.3	-0.9	8.3	3.8	6.7	-0.5	-0.2	38.3	11.4	63.7	10.4	4/30/1997
High Variability of EPS	Risk	-1.3	-6.3	1.8	-2.1	2.1	-0.8	-0.4	51.3	14.8	41.6	7.2	12/31/1988
Relative Strength (5wk/30wk)	Technical	-1.5	-4.1	-0.1	-1.3	1.3	1.4	0.7	71.8	19.8	61.0	10.0	1/31/2010
Low Price to Book Value	Value	-1.9	-16.4	-7.4	-12.9	-5.7	-9.9	-5.1	63.6	17.8	14.9	2.8	12/31/1988
Upward Estimate Revisions	Growth	-2.0	-3.6	2.6	7.7	2.1	21.8	10.4	111.0	28.3	76.4	12.0	12/31/1988
Low EPS Torpedo	Growth (Negative)	-2.1	-11.3	3.7	-4.0	1.5	-5.7	-2.9	82.2	22.1	62.1	10.1	12/31/1988
Earnings Yield	Value	-2.2	-16.3	-9.8	-17.1	-7.6	-17.7	-9.3	40.2	11.9	-1.2	-0.2	12/31/1988
Most Active	Technical	-2.3	-5.3	2.9	-3.3	6.8	-0.4	-0.2	68.7	19.0	62.4	10.2	8/31/2003
Low Price	Risk	-2.6	-13.0	-4.5	-10.9	-3.4	-4.5	-2.3	81.5	22.0	36.3	6.4	12/31/1988
Price Returns (3-Month)	Technical	-2.9	-6.6	0.0	-8.1	0.2	-7.6	-3.9	63.4	17.8	45.2	7.8	1/31/2010
Forward Earnings Yield	Value	-3.0	-17.2	-12.1	-11.7	-8.5	-5.1	-2.6	64.1	17.9	13.3	2.5	12/31/1988
High Foreign Exposure	Miscellaneous	-3.3	-3.5	14.0	4.6	7.2	2.3	1.2	72.4	19.9	74.0	11.7	12/31/1988
High EPS Estimate Dispersion	Risk	-4.6	-9.5	5.2	1.7	6.9	8.8	4.3	98.7	25.7	24.5	4.5	12/31/1988
High Beta	Risk	-4.6	-13.7	-2.5	-8.2	-0.6	-3.5	-1.8	80.6	21.8	44.8	7.7	12/31/1988

Source: BofA US Equity and Quant Strategy, FactSet

The performance does not reflect transaction costs or tax withholdings or any applicable advisory fees. Had these costs been reflected, the performance would have been lower. Performance is calculated on the basis of price return unless noted. Total return performance calculations assume that dividends paid on securities in a portfolio are deposited in a cash account on the ex-dividend date, and are not reinvested. Please see Performance Calculation methodology on page 60 for a full explanation.

†For screens that have less than 5 years history, the performance is since inception.

Past performance should not and cannot be viewed as an indicator of future performance. A complete performance record is available upon request

Exhibit 9: Rising Short Interest underperformed all bottom decile factors we follow in April
Quantitative Strategies Performance (Bottom Decile, as of 4/30/2023)

Strategies (Universe based on the S&P 500)		1 M	3 M	6 M	12 M	YTD	2 Yr Perf. Gross	2 Yr Perf. Anlzd	3 Yr Perf. Gross	3 Yr Perf. Anlzd	5 Yr Perf. Gross	5 Yr Perf. Anlzd	Inception Date
Rising Short Interest	Miscellaneous	-3.6	-10.0	-1.1	-10.2	-2.1	-11.0	-5.7	54.1	15.5	44.9	7.7	4/30/1994
Relative Strength (30wk/75wk)	Technical	-2.7	-10.4	7.1	1.7	6.5	4.3	2.1	99.8	25.9	39.1	6.8	3/1/2001
Price Returns (12-Month)	Technical	-2.5	-10.8	6.7	-6.4	6.8	-8.4	-4.3	81.9	22.1	43.5	7.5	2/27/1987
Low Estimate Revisions	Growth	-2.4	-11.8	6.5	0.6	2.7	-8.4	-4.3	64.9	18.1	31.2	5.6	3/1/2001
Earnings Torpedo	Growth	-2.1	-11.3	3.7	-4.0	1.5	-5.7	-2.9	82.2	22.1	62.1	10.1	
Low Share Repurchase	Cash Deployment	-1.9	-11.5	-5.9	-12.6	-2.6	-9.0	-4.6	32.8	9.9	31.4	5.6	3/31/2005
Dividend Discount Model Alpha	Value	-1.8	-3.0	9.3	2.1	5.9	-1.7	-0.9	76.1	20.8	47.5	8.1	3/30/2001
No Dividend Yield	Cash Deployment	-1.7	-3.1	9.2	3.9	9.4	-9.8	-5.0	53.9	15.5	74.4	11.8	3/1/2001
Price Returns (3-Month)	Technical	-1.6	-8.5	5.1	-2.7	4.9	0.8	0.4	60.6	17.1	50.2	8.5	2/27/1987
Relative Strength (10wk/40wk)	Technical	-1.6	-13.0	1.6	-6.2	1.4	-13.0	-6.7	36.9	11.0	14.4	2.7	2/27/1987
Price Returns (12-Month plus 1-Month)	Technical	-1.6	-11.8	4.6	-9.4	4.4	-9.4	-4.8	71.3	19.6	63.2	10.3	2/27/1987
Low Projected 5-Yr Growth	Growth	-1.2	-12.6	-0.4	-4.9	-3.3	-5.6	-2.8	58.9	16.7	38.2	6.7	3/1/2001
High Price/ Cash Flow	Value	-1.1	2.8	11.6	10.0	12.5	-5.1	-2.6	44.0	12.9	83.6	12.9	8/1/2003
Low Variability of Earnings	Risk	-1.1	-4.9	2.4	6.2	-1.5	4.3	2.1	47.6	13.9	54.6	9.1	3/1/2001
Relative Strength (5wk/30wk)	Technical	-1.0	-9.8	4.2	-5.0	4.0	-7.8	-4.0	38.3	11.4	25.3	4.6	2/27/1987
Price Returns (9-Month)	Technical	-1.0	-13.6	2.4	-11.1	3.1	-11.2	-5.7	54.0	15.5	5.8	1.1	2/27/1987
Relative Strength (Price/200D Moving Avg)	Technical	-1.0	-11.9	2.5	-10.2	3.1	-14.3	-7.4	34.5	10.4	7.7	1.5	2/27/1987
Price Returns (11-Month since 1 year ago)	Technical	-0.8	-9.5	7.1	-5.2	7.2	-8.7	-4.4	76.7	20.9	34.3	6.1	2/27/1987
Low Duration	Growth	-0.6	-8.7	-2.9	8.5	0.1	14.1	6.8	96.2	25.2	43.7	7.5	3/1/2001
High EV/ EBITDA	Value	-0.6	3.1	12.5	8.1	12.1	-3.0	-1.5	50.1	14.5	98.1	14.7	10/30/2004
Low Forward Earnings Yield	Value	-0.4	-2.9	8.8	-2.9	8.4	-12.5	-6.4	37.1	11.1	40.5	7.0	5/31/2005
Low Free Cash Flow/ EV	Value	-0.4	-3.5	4.6	-3.8	3.3	-5.0	-2.5	80.4	21.7	57.8	9.6	3/1/2001
Price Returns (12-m plus 1-m Reversal)	Technical	-0.3	-0.5	8.8	-0.1	10.2	-2.9	-1.5	63.5	17.8	12.7	2.4	2/27/1987
Most Active	Technical	-0.1	-0.8	10.5	8.1	6.7	-1.5	-0.8	49.8	14.4	62.5	10.2	8/31/2003
Low Dividend Growth	Cash Deployment	-0.1	-8.4	-0.6	-0.4	-1.4	-2.4	-1.2	88.7	23.6	45.8	7.8	9/30/2004
S&P 500 Equal Weighted (Price Return)	Benchmark	0.1	-4.4	4.1	-1.4	2.8	-2.0	-1.0	51.4	14.8	45.6	7.8	
S&P 500 Equal Weighted (Total Return)	Benchmark	0.2	-3.9	5.2	0.7	3.4	1.8	0.9	60.4	17.1	61.2	10.0	
High Price/ Sales	Value	0.3	0.9	8.2	-0.3	8.8	-6.1	-3.1	28.6	8.8	57.0	9.4	3/31/2001
Low ROE (1-Yr Avg. Adj. by Debt)	Quality	0.3	-1.1	7.7	10.6	6.1	8.4	4.1	57.8	16.4	64.6	10.5	3/1/2001
High Price/ Book Value	Value	0.3	1.3	7.3	11.1	7.8	6.5	3.2	53.7	15.4	87.1	13.4	3/30/2001
Low Earnings Yield	Value	0.5	-3.8	7.4	7.4	9.0	-3.1	-1.5	85.1	22.8	59.8	9.8	3/30/2001
High Price	Risk	0.5	0.6	8.8	8.4	6.4	-0.6	-0.3	43.9	12.9	67.2	10.8	7/30/1986
Low ROA	Quality	0.6	-5.7	6.2	6.1	7.9	-0.1	-0.1	89.3	23.7	60.5	9.9	3/1/2001
High Analyst Coverage	Miscellaneous	0.6	2.9	12.0	13.6	13.9	9.6	4.7	69.5	19.2	68.0	10.9	3/1/2001
High Price/ Free Cash Flow	Value	0.6	-0.7	6.0	4.9	6.3	-5.7	-2.9	44.0	12.9	61.9	10.1	8/1/2003
High Institutional Ownership	Miscellaneous	0.7	-13.5	-6.8	-7.9	-4.8	-11.0	-5.6	45.2	13.2	20.8	3.9	3/1/2001
Low ROE (1-Yr Average)	Quality	0.8	-5.2	5.6	9.3	6.6	0.9	0.4	86.0	23.0	59.2	9.7	3/31/1986
Low ROC	Quality	0.8	-5.6	7.1	5.7	7.2	1.4	0.7	89.2	23.7	49.5	8.4	3/1/2001
Forecast Negative Earnings Surprise	Growth	0.8	-7.5	1.3	-1.0	-1.6	-0.4	-0.2	52.0	15.0	38.7	6.8	3/31/1986
Low EPS Momentum	Growth	0.9	-5.3	2.6	6.5	3.9	-3.6	-1.8	78.9	21.4	50.9	8.6	3/1/2001
Low ROE (5-Yr Average)	Quality	0.9	-7.0	0.5	7.5	3.1	19.5	9.3	104.9	27.0	68.9	11.0	3/1/2001
Low Foreign Exposure	Miscellaneous	1.0	-8.9	-4.7	-2.0	-3.7	2.9	1.4	50.6	14.6	39.5	6.9	1/31/1995
Low ROE (5-Yr Avg. Adj. by Debt)	Quality	1.1	-0.9	6.4	10.1	5.1	5.1	2.5	51.7	14.9	58.1	9.6	3/1/2001
High P/E-to-Growth	GARP	1.1	-0.7	7.3	3.0	5.3	2.7	1.3	43.1	12.7	33.9	6.0	3/30/2001
S&P 500 Index (Price Return)	Benchmark	1.5	2.3	7.7	0.9	8.6	-0.3	-0.1	43.2	12.7	57.5	9.5	
Low EPS Estimate Dispersion	Risk	1.6	-1.6	3.2	5.8	0.4	10.0	4.9	41.7	12.3	52.1	8.8	2/28/1989
Large Size	Miscellaneous	1.6	2.9	8.5	4.7	7.9	2.2	1.1	37.6	11.2	56.5	9.4	3/1/2001
Low Beta	Risk	2.5	2.9	6.5	9.6	3.7	20.1	9.6	37.1	11.1	51.3	8.6	7/30/1986

Source: BofA US Equity and Quant Strategy, FactSet

The performance does not reflect transaction costs or tax withholdings or any applicable advisory fees. Had these costs been reflected, the performance would have been lower. Performance is calculated on the basis of price return unless noted. Total return performance calculations assume that dividends paid on securities in a portfolio are deposited in a cash account on the ex-dividend date, and are not reinvested. Please see Performance Calculation methodology on page 60 for a full explanation.

†For screens that have less than 5 years history, the performance is since inception.

Past performance should not and cannot be viewed as an indicator of future performance. A complete performance record is available upon request.

The table below includes factors ranked by the most expensive / crowded long factors relative to least expensive / crowded short factors. Long-short factors toward the top of the table could have more downside risk on valuations/positioning, all else being equal.

Exhibit 10: Factor valuations and positioning as of 4/30/2023
Long-short factors listed from most to least expensive & crowded using a multi-indicator ranking

	Long Factors (S&P 500 top decile)				Short Factors (S&P 500 bottom decile)				
	Price to Book (Relative)	Forward P/E (Relative)	Crowdedness	Long Rank	Price to Book (Relative)	Forward P/E (Relative)	Crowdedness	Short Rank	
Factor	Relative multiple vs. history (>1 = expensive vs. history)	Relative multiple vs. history (>1 = expensive vs. history)	Long Only Funds' Relative Wt.	Rank for Long Factor (1=most expensive / most crowded)	Relative multiple vs. history (>1 = expensive vs. history)	Relative multiple vs. history (>1 = expensive vs. history)	Long Only Funds' Relative Wt.	Rank for Short Factor (1=least expensive / least crowded)	Rank for long-short factor (1=most downside risk)
High (Low) Price Returns (9-Month)	1.31	0.96	1.32	5	0.70	0.64	0.78	2	1
High (Low) Rel. Strength (Price/200-Day MA)	1.30	1.20	1.30	1	0.60	0.51	1.00	5	2
Forecast Positive (Negative) EPS Surprise	1.28	1.03	1.18	8	0.71	0.94	0.83	4	3
High (Low) Relative Strength (5wk/30wk)	1.71	1.23	1.09	2	0.71	0.49	1.08	12	4
High (Low) Duration	1.73	1.13	1.02	7	0.85	0.46	0.95	7	5
High (Low) Price Returns (3-Month)	1.45	1.23	1.08	3	0.62	0.49	1.17	14	5
High (Low) Relative Strength (10wk/40wk)	1.32	1.02	1.31	3	0.99	0.68	0.94	16	7
High (Low) Price Returns (12-m + 1-m)	1.00	1.07	1.20	9	0.53	0.53	1.09	10	8
High (Low) Price Returns (12-Month)	1.28	1.01	1.12	11	0.83	0.77	0.92	10	9
High (Low) Dividend Growth	0.86	0.72	1.15	24	0.70	0.67	0.69	1	10
High (No) Foreign Exposure	1.06	0.90	1.15	16	0.81	0.92	0.93	12	11
High (Low) ROE (1-Yr Average)	1.33	1.13	0.86	14	na	1.15	0.86	20	12
Low EPS Torpedo	na	na	0.78	28	0.73	0.57	0.78	3	13
High (Low) ROC	1.89	1.02	0.84	15	0.90	1.10	0.80	16	14
High (Low) Projected 5-Yr Growth	0.76	0.77	1.26	22	0.88	0.67	0.87	5	15
High (Low) ROE (5-Yr Average)	1.92	1.08	0.86	11	0.72	0.92	1.22	24	16
High (Low) ROA	0.99	1.01	1.05	18	0.88	1.04	0.89	16	17
High (Low) Price Ret. (11-m since 1 y ago)	1.14	1.03	1.11	11	1.05	1.00	0.96	25	17
Falling (Rising) Short Interest	0.85	0.96	1.16	17	0.78	0.98	0.98	21	19
High (Low) ROE (5-Yr Avg. Adj. by Debt)	0.97	1.10	1.21	9	1.89	1.14	0.85	29	20
High (Low) EPS Estimate Dispersion	1.11	0.54	0.99	29	0.70	1.06	0.91	9	21
High (Low) Price Ret. (12-m + 1-m Reversal)	1.24	1.12	1.18	5	1.36	1.33	0.97	37	22
High (Low) Upward Estimate Revisions	1.04	0.76	1.06	20	1.02	0.72	1.01	22	23
High (Low) Beta	1.10	0.69	0.93	29	1.07	1.06	0.75	15	23
High (Low) Free Cash Flow to EV	0.78	0.80	0.81	33	0.92	0.96	0.76	7	25
High (Low) Share Repurchase	0.78	0.76	1.23	21	0.80	1.33	0.93	22	26
Low (High) PE to GROWTH	0.91	0.76	1.01	25	0.95	1.03	0.98	25	27
High (Low) EPS Momentum	0.85	0.67	0.92	35	0.75	0.97	0.95	16	28
High (Low) ROE (1-Yr Avg. Adj. by Debt)	0.80	0.96	1.06	23	1.77	1.11	0.87	29	29
Low (High) Institutional Ownership	1.20	1.04	0.77	19	1.73	1.24	0.95	36	30
High (Low) Relative Strength (30wk/75wk)	0.77	0.81	1.11	27	1.08	1.08	1.04	32	31
High (Low) Variability of EPS	0.75	0.82	0.87	31	0.85	1.08	1.14	28	32
Low (High) Analyst Coverage	0.88	1.14	0.40	26	1.62	1.13	1.04	37	33
High (Low) Earnings Yield	0.78	0.70	0.82	41	1.05	1.20	0.94	27	34
Small (Large) Size	0.99	0.74	0.53	35	1.09	1.28	0.97	33	35
Most (Least) Active	0.57	0.67	0.94	42	1.24	1.30	0.91	29	36
Low (High) DDM Valuation	0.67	0.71	0.95	39	1.69	1.25	0.95	35	37
Low (High) Price to Book Value	0.82	0.61	0.83	40	1.40	1.50	0.94	34	38
Low (High) Price to Free Cash Flow	0.84	0.81	0.75	34	1.34	1.61	1.20	42	39
Low (High) Price to Cash Flow	0.97	0.72	0.76	35	1.17	2.01	1.20	41	40
Low (High) EV/EBITDA	0.81	0.79	0.76	38	1.52	2.01	1.13	43	41
Low (High) Price to Sales	0.89	0.75	0.77	32	1.62	1.86	1.21	45	42
High (Low) Dividend Yield	0.77	0.70	0.48	44	1.22	1.25	1.09	39	43
High (Low) Forward Earnings Yield	0.70	0.75	0.73	43	1.36	2.71	1.07	40	44
Low (High) Price	0.64	0.50	0.68	45	1.53	1.35	1.48	44	45

Source: BofA US Equity and Quant Strategy, FactSet. Based on data since February 2001.For the following short factors valuation data are available as indicated: Fwd EPS Yield since 4/05; Price/ Cash Flow and Price / Free Cash Flo since 7/03; EV/EBITDA since 9/04; FCF/EV since 9/12; Dividend Growth since 8/04; Share Repurchase since 2/05; Most Active since 7/03; Analyst Coverage since 11/05; Foreign Exposure since 7/03. Relative multiple vs. history is based on relative valuation the factor versus the S&P 500 and calculated as the latest value dividend by historic average. Long Only Funds' Relative Wt. (Avg.) is calculated as the average of individual factor constituents' relative weight in funds vs. weight in the index. Long Rank is calculated as the average of ranks of Price / Book, Fwd P/E and Long Only Funds' relative ownership with rank =1 indicating most expensive and most crowded long factor. Short Rank is based on the average of ranks of Price / Book, Fwd P/E and Long Only Funds' relative ownership with rank =1 indicating least expensive and least crowded short factor. Long/Short Rank is based on the average of Long Rank and Short Rank with rank = 1 indicating long / short factor with most downside risk. Fund holdings data as of 12/31/2021

Exhibit 11: Advances and Declines (Top Decile)
As of 4/30/2023

	1M		3M		6M		12M		YTD		2Yr		3Yr		5Y	
Quantitative Strategies	**Adv.**	**Dec.**	**Adv.**	**Dec.**	**Adv.**	**Dec.**	**Adv.**	**Dec.**	**Adv.**	**Dec.**	**Adv.**	**Dec.**	**Adv.**	**Dec.**	**Adv.**	**Dec.**
Price Returns (12-Month)	33	17	69	81	148	152	305	294	100	100	610	588	978	820	1615	1381
Price Returns (11-Month since 1 year ago)	33	17	71	79	147	153	307	292	103	97	591	607	958	840	1594	1403
Price Returns (12-m plus 1-m Reversal)	29	21	71	79	162	138	315	284	108	92	596	602	968	830	1637	1360
Share Repurchase	31	19	54	96	150	150	295	305	98	102	612	588	1016	782	1642	1355
Short Interest	31	18	70	75	162	129	288	295	107	86	564	606	947	811	1612	1312
Analyst Coverage Neglect	32	24	69	92	156	147	261	278	118	96	539	550	966	749	1607	1250
Relative Strength (30wk/75wk)	32	18	71	79	142	158	300	300	98	102	592	608	955	846	1600	1405
High Dividend Growth (Price Return)	29	21	56	94	149	151	298	302	102	98	624	576	1005	795	1626	1373
Price Returns (12-Month plus 1-Month)	27	23	74	76	144	156	275	325	98	102	586	614	989	810	1639	1358
Forecast Negative Earnings Surprise	48	30	104	147	258	235	487	490	169	169	913	924	1470	1269	2457	2069
Dividend Yield (Price Return)	26	22	49	99	144	154	285	312	92	106	615	581	1005	789	1637	1356
Low PE to GROWTH	28	22	50	100	135	165	285	315	91	109	595	605	1002	797	1577	1421
Low Price to Free Cash Flow	25	25	48	102	137	163	276	324	87	113	570	630	938	861	1541	1458
DDM Valuation	21	18	40	68	102	114	208	238	67	73	511	527	913	828	1692	1518
ROE (1-Yr Average)	26	24	75	75	160	140	299	300	111	89	605	594	992	807	1686	1313
ROE (5-Yr Average)	26	24	70	80	155	145	297	302	107	93	597	602	973	825	1654	1344
High Free Cash Flow to EV	18	20	40	76	99	135	217	263	67	88	454	518	764	693	1254	1176
Institutional Neglect	25	25	65	85	157	142	289	309	103	97	597	600	972	826	1645	1354
Low EV/EBITDA	23	27	53	97	146	154	294	306	96	104	592	608	974	825	1558	1441
ROE (5-Yr Avg. Adj. by Debt)	20	30	82	68	182	118	302	298	130	70	604	596	1002	798	1673	1327
High Duration	27	23	79	71	171	129	286	314	115	85	576	624	958	842	1645	1354
High Projected 5-Yr Growth	25	25	58	92	143	157	285	315	97	103	586	614	962	841	1596	1405
Forecast Positive Earnings Surprise	32	40	76	141	204	241	404	483	128	162	820	888	1381	1184	2354	1927
ROA	25	25	76	74	173	127	305	295	121	79	605	595	1000	800	1704	1296
Relative Strength (Price/200D MA)	23	27	67	83	140	160	288	312	98	102	598	602	1001	799	1657	1339
EPS Momentum	28	21	59	90	144	155	288	311	100	99	599	600	973	825	1583	1414
Relative Strength (10wk/40wk)	22	28	60	90	137	163	297	303	93	107	579	621	976	824	1632	1362
Price Returns (9-Month)	24	26	64	86	131	169	292	308	94	106	591	609	976	824	1631	1365
Low Price to Sales	25	25	46	104	137	163	284	316	88	112	588	612	969	831	1590	1409
Low Price to Cash Flow	20	30	47	103	141	159	280	320	90	110	571	629	928	871	1517	1481
Small Size	22	28	43	107	140	160	273	327	90	110	567	633	976	822	1570	1425
ROE (1-Yr Avg. Adj. by Debt)	23	27	74	76	168	132	296	304	120	80	605	595	995	805	1650	1350
ROC	24	26	72	78	164	136	305	295	115	85	596	604	984	816	1696	1303
High Variability of EPS	29	35	71	121	183	199	364	399	122	133	740	763	1247	1083	2175	1867
Relative Strength (5wk/30wk)	21	29	57	93	138	162	282	318	92	108	593	607	1004	796	1647	1347
Low Price to Book Value	22	27	43	106	141	158	287	312	89	110	609	597	1025	789	1633	1397
Upward Estimate Revisions	17	33	58	92	150	150	312	287	97	103	627	572	1056	742	1685	1311
Low EPS Torpedo	24	26	54	96	157	143	301	299	100	100	598	602	975	824	1600	1397
Earnings Yield	23	26	44	105	135	164	276	323	87	112	591	608	994	804	1594	1404
Most Active	23	26	64	85	156	141	288	309	109	90	589	608	936	860	1583	1412
Low Price	22	26	43	105	139	159	279	318	90	108	573	623	967	825	1576	1414
Price Returns (3-Month)	18	32	57	93	145	155	272	328	95	105	571	629	986	814	1622	1374
Forward Earnings Yield	21	28	43	106	135	164	293	306	88	111	596	603	983	814	1590	1407
High Foreign Exposure	14	36	57	93	159	140	298	301	102	98	587	611	995	801	1649	1345
High EPS Estimate Dispersion	17	24	47	81	132	136	246	257	89	86	409	416	667	611	1040	983
High Beta	19	34	50	104	149	160	293	328	100	106	612	623	1012	841	1638	1465

Source: BofA US Equity and Quant Strategy, FactSet

Exhibit 12: Advances and Declines (Bottom Decile)

As of 4/30/2023

	1M		3M		6M		12M		YTD		2Yr		3Yr		5Yr	
Quantitative Strategies	**Adv.**	**Dec.**	**Adv.**	**Dec.**	**Adv.**	**Dec.**	**Adv.**	**Dec.**	**Adv.**	**Dec.**	**Adv.**	**Dec.**	**Adv.**	**Dec.**	**Adv.**	**Dec.**
Short Interest	18	31	51	98	146	153	279	320	94	105	575	622	962	834	1610	1371
Relative Strength - 30wk/75wk MA	22	28	58	92	156	145	288	313	107	93	584	616	973	825	1583	1416
Price Returns (12-Month)	22	27	54	95	153	146	284	315	104	95	569	630	950	847	1572	1423
Low EPS Estimate Revisions	24	26	55	95	155	144	283	316	102	98	567	631	947	850	1562	1433
Low Share Repurchase	28	21	56	93	142	157	271	327	99	100	584	614	935	860	1622	1371
Dividend Discount Model Alpha	26	40	79	111	192	184	341	418	131	122	690	797	1130	958	1877	1674
Low Dividend Yield	46	60	140	175	330	298	603	659	233	186	1250	1375	2177	1894	3367	2782
Price Returns (3-Month)	21	28	55	94	151	148	285	314	102	97	603	596	966	832	1601	1395
Relative Strength (10wk/40wk)	26	24	52	98	149	151	281	319	100	100	570	630	921	878	1544	1453
Price Returns (12-Month plus 1-Month)	24	24	56	92	149	149	276	322	104	94	568	630	950	848	1614	1384
Low Proj. 5yr EPS Growth	21	28	48	101	147	152	285	317	92	107	579	624	950	853	1574	1425
High Price/ Cash Flow	22	28	76	74	158	141	288	311	117	83	567	632	952	847	1653	1344
Low Variability of Earnings	30	22	72	87	163	157	316	315	106	107	662	652	1086	885	1760	1375
Relative Strength (5wk/30wk)	26	23	58	91	156	143	291	308	106	93	593	606	939	858	1572	1423
Price Returns (9-Month)	26	24	50	100	148	152	272	328	99	101	566	634	928	870	1530	1466
Relative Strength (Price/200-Day Moving Avg)	25	24	55	94	153	146	280	319	103	96	570	629	916	881	1537	1458
Price Returns (11-Month since 1 year ago)	24	25	57	92	151	148	280	319	106	93	568	631	948	849	1555	1441
Low Equity Duration	26	24	48	102	136	164	285	315	91	109	601	599	1007	793	1609	1390
High EV/ EBITDA	21	29	74	76	152	147	278	321	115	85	573	626	959	840	1672	1326
Low Forward Earnings Yield	24	25	63	86	147	151	256	341	106	93	551	646	894	902	1570	1422
FCF / EV	23	14	48	65	117	111	236	230	73	78	476	470	761	660	1299	1073
Price Returns (12-Month plus 1-Month Reversal)	23	27	62	88	152	148	284	316	106	94	590	610	992	805	1574	1423
Least Active	24	26	68	82	161	139	285	315	110	90	587	613	981	819	1666	1334
Low Dividend Growth	24	26	49	101	146	154	279	319	92	108	566	632	958	839	1581	1414
High Price/ Sales	26	24	78	72	162	138	270	329	121	79	575	624	942	857	1655	1343
Low 1yr ROE Adj	26	24	72	78	161	139	298	301	111	89	590	609	972	826	1646	1352
High Price/ Book Value	28	22	82	68	163	137	300	299	118	82	596	603	970	829	1675	1325
Low Earnings Yield	26	24	60	90	143	156	269	329	102	98	554	643	932	863	1559	1430
High Price	27	23	77	73	161	139	289	311	113	87	590	610	979	821	1677	1321
Low ROA	28	22	55	95	147	152	283	315	101	99	575	622	953	843	1578	1413
High Analyst Coverage	37	24	92	77	188	140	343	332	139	81	656	676	1078	919	1795	1499
High Price/ Free Cash Flow	29	21	76	74	160	140	287	313	113	87	573	627	965	835	1655	1344
High Institutional Ownership	29	23	51	101	144	158	280	321	97	105	574	626	983	817	1641	1412
Low 1yr ROE	28	22	58	92	150	149	290	309	100	100	575	623	950	847	1588	1406
Low ROC	29	21	59	91	151	148	285	312	102	98	582	614	952	842	1563	1426
Negative EPS Surprise	48	30	104	147	258	235	487	490	169	169	913	924	1470	1269	2457	2069
Low Earning Momentum	29	21	58	92	142	158	283	315	96	104	559	639	931	866	1571	1424
Low 5y ROE	29	21	51	99	142	158	284	316	93	107	599	600	971	828	1592	1402
Low Foreign Exposure	72	48	143	225	354	387	691	771	232	260	1438	1470	2366	1988	4004	3256
Low 5yr ROE Adj	29	21	73	77	160	140	298	301	109	91	587	612	968	830	1642	1356
High P/E-to-Growth	31	19	73	77	162	137	289	308	108	91	588	609	961	834	1624	1369
Low Estimate Dispersion	60	28	133	135	268	261	503	527	181	175	1037	1019	1634	1381	2797	2173
Large Size	33	17	84	66	172	127	290	309	119	81	598	601	965	834	1671	1328
Low Beta	34	18	90	64	176	131	335	285	114	90	656	579	1000	858	1736	1343

Source: BofA US Equity and Quant Strategy, FactSet

Note on back testing

The analysis of certain indicators in this report is back-tested and does not represent the actual performance of any account or fund. Back-tested performance depicts the hypothetical back-tested performance of a particular strategy over the time period indicated. In future periods, market and economic conditions will differ and the same strategy will not necessarily produce the same results. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. In fact, there are frequently sharp differences between back-tested returns and the actual results realized in the actual management of a portfolio. Back-tested performance results are created by applying an investment strategy or methodology to historical data and attempts to give an indication as to how a strategy might have performed during a certain period in the past if the product had been in existence during such time. Back-tested results have inherent limitations including the fact that they are calculated with the full benefit of hindsight, which allows the security selection methodology to be adjusted to maximize the returns. Further, the results shown do not reflect actual trading or the impact that material economic and market factors might have had on a portfolio manager's decision-making under actual circumstances. Back-tested returns do not reflect advisory fees, trading costs, or other fees or expenses

Value vs. Growth

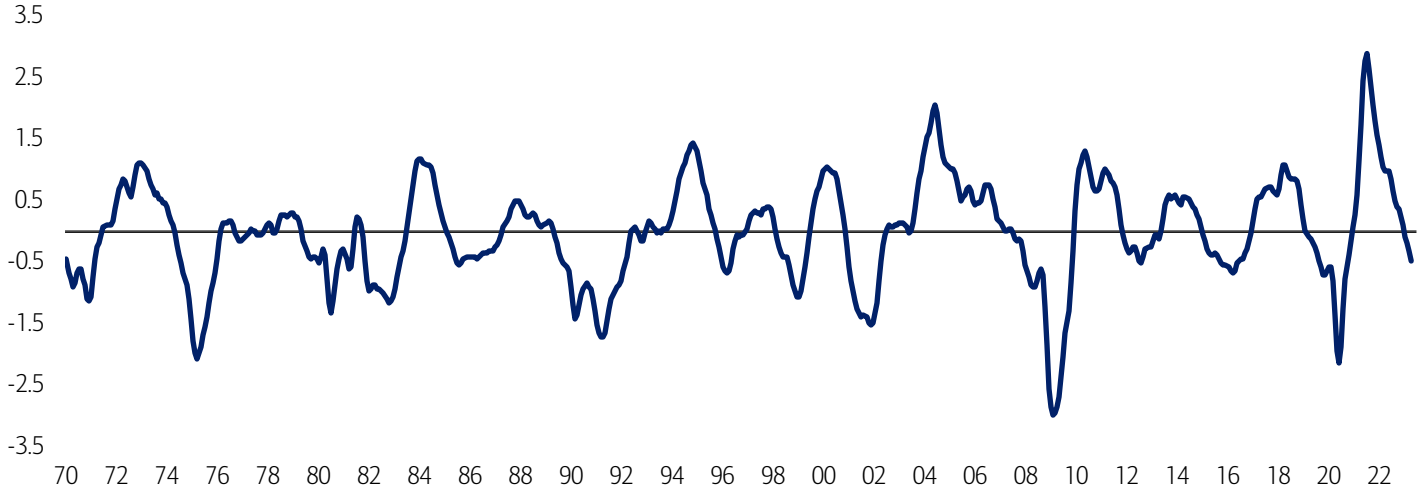
We prefer Quality / Cash-Flow based Value over Deep Value

We prefer Value to Growth for the next twelve months, but would avoid deep value factors like price to book or price to sales in a downturn. Profits growth is likely to slow demonstrably from here, presenting a risk to a strong Value tilt.

Lessons from the 70s: Value>Growth, Small>Large

We extended the US Regime Indicator history an additional 20 years back to 1970. While not all inputs were available over the additional history (see Appendix), and we continue to present returns of our S&P 500 factors over the original history (on a hypothetical backtested basis since 1990), we use the extended history to analyze size, style and asset class performance in a comparable high inflation environment (based on Fama-French data for size/style).

Exhibit 13: Downturn starts during high inflation era
Extended US Regime Indicator (1970 – present)



Source: BofA US Equity & Quant Strategy, Refinitiv, ICE Data Indices, LLC, Institute for Supply Management, Bureau of Labor Statistics, Federal Reserve
Note: Phase 1 – Early Cycle; Phase 2 – Mid Cycle; Phase 3 – Late Cycle; Phase 4 – Recession
Disclaimer: The indicator identified as the US Regime Indicator above is intended to be an indicative metric only and may not be used for reference purposes or as a measure of performance for any financial instrument or contract, or otherwise be relied upon by third parties for any other purpose, without the written consent of BofA Global Research. This indicator was not created to act as a benchmark.
For the historic period from January 1970 to December 1989, the US Regime Indicator was based on the available inputs, which were:
1/70 to 1/82: 5 inputs: Inflation, 10-yr US Treasury Bond Yield, ISM PMI, Leading Economic Indicators index, US Capacity Utilization;
2/82 to 3/88: 6 inputs: all of the above plus GDP Forecast;
4/88 to 4/89: 7 inputs: all of the above plus the High Yield corporate bond credit spread;
5/89 to 12/89: all 8 inputs: all of the above plus the Earnings Revision Ratio.
Performance of styles during regimes prior to January 1990 could be impacted by the more limited set of factors used to determine regimes, different definitions for Growth, Value and Size, as well as the different macro backdrop in the earlier period marked by high inflation.

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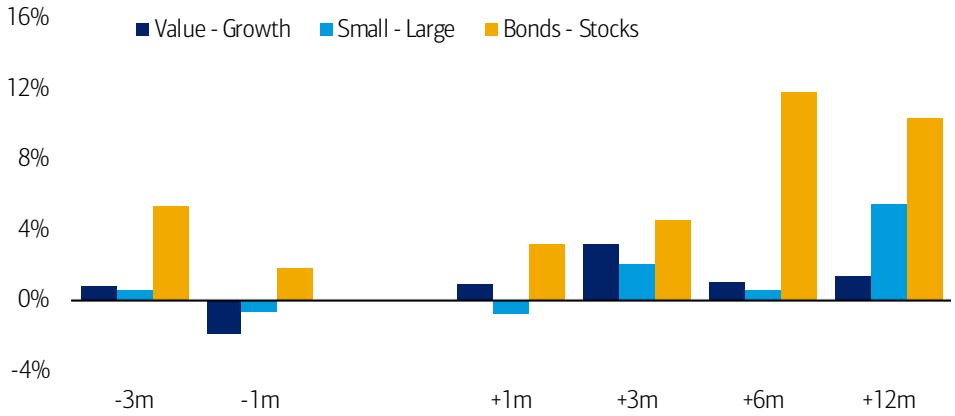
During Downturn regimes of the 1970s and early 1980s (through '82), Value led Growth in the three months prior to a Downturn, and continued to lead Growth for up to 12 months after the onset of a Downturn (Exhibit 14). Small Caps led Large Caps in the three months before Downturns, and continued to outperform in the three, six and 12 months after the onset of a Downturn. Bonds outperformed stocks in the 3-months before and three/six/12 months after the onset of a Downturn.

Exhibit 14: 70s / early 80s Downturn phases saw Value outperform Growth, Small outperform Large (3-mth, 6-mth and 12-mth) and Bonds outperform Stocks
Factor performance prior and after entering Downturn during period of high inflation in the 70s / 80s

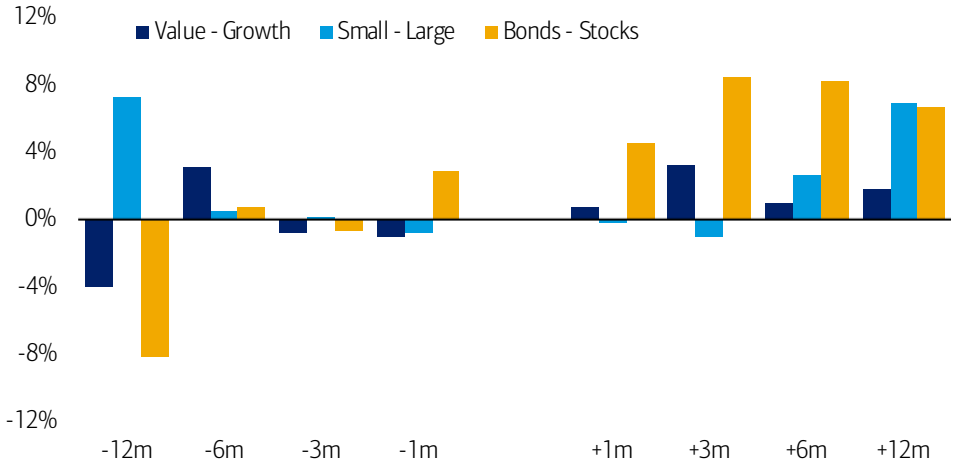


Source: US Equity & Quant Strategy, Dartmouth University data library; Fama-French definition of Value, Growth, Small Cap and Large Cap
BofA GLOBAL RESEARCH

Value led even after hiking stopped

When the Fed fought inflation in the 70s, it took several hike cycles to get inflation in check. Even after the Fed was done, Value consistently led Growth for the next 12 months (Exhibit 15). Small Caps mostly led Large before the last hike (except for the last month), stumbled in the 3-mth after last hike, but subsequently led Large Caps in the six months and 12 months periods. Bonds generally led equities before last hike, and consistently led after (supporting our overweight of the bond-like Utilities sector).

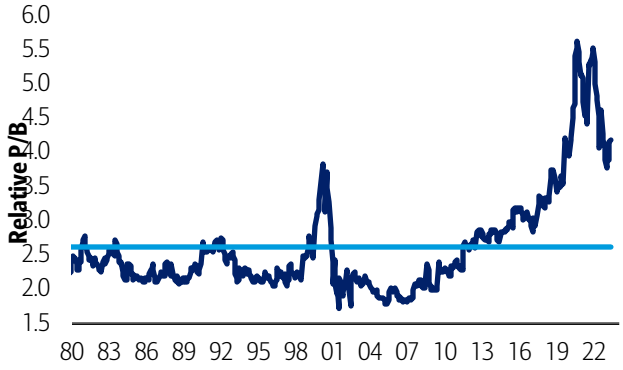
Exhibit 15: After the last Fed hike in the 70s / early 80s Value led Growth, Small led Large (6-mth and 12-mth) and bonds led stocks
Factor performance prior and after the last Fed hike during period of high inflation in the 70s / 80s



Source: Bloomberg, US Equity & Quant Strategy; Dartmouth university data library; Fama-French definition of Value, Growth, Small Cap and Large Cap

BofA GLOBAL RESEARCH

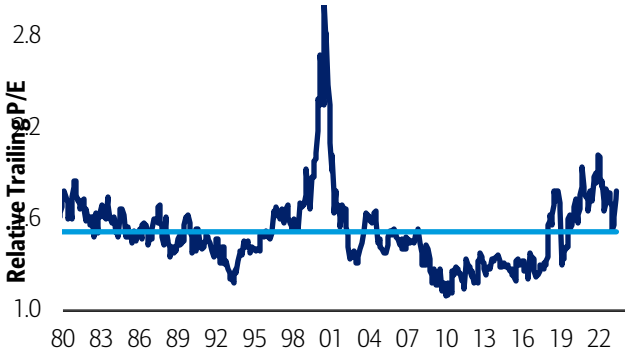
Exhibit 16: Growth valuations vs Value remain at historically high levels
Russell 1000 Growth vs Russell 1000 Value relative Price to Book Value, Jan. 1980 – April 2023



Source: FactSet, BofA US Equity & Quant Strategy

BofA GLOBAL RESEARCH

Exhibit 17: Growth valuations vs Value remain elevated vs. the historical average
R Russell 1000 Growth vs Russell 1000 Value relative Price to trailing EPS, Jan. 1980 – April 2023



Source: FactSet, BofA US Equity & Quant Strategy

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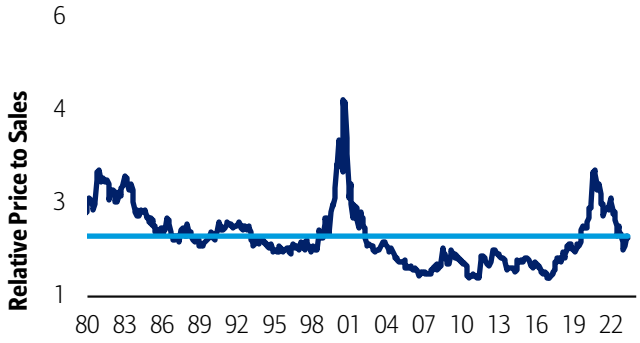
Exhibit 18: Growth vs Value is near its historical average level on Price to Sales
Russell 1000 Growth vs Russell 1000 Value relative Price to Sales Value, Jan. 1980 – April 2023



Source: FactSet, BofA US Equity & Quant Strategy

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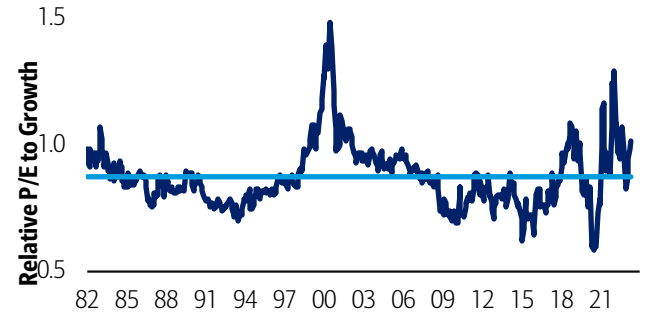
Exhibit 19: Growth valuations vs Value are above its historical average level
Russell 1000 Growth vs Russell 1000 Value relative PE-to-Growth, Jan. 1980 – April 2023



Source: FactSet, BofA US Equity & Quant Strategy

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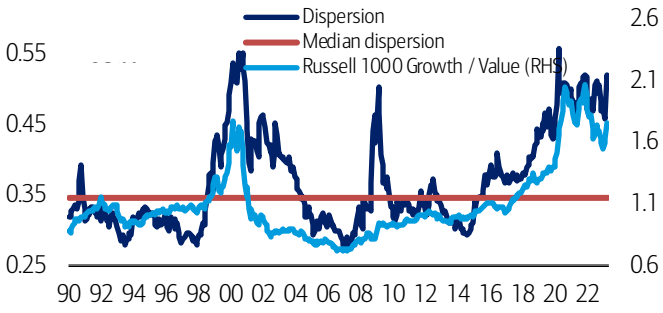
Exhibit 20: Valuations dispersion remains elevated
S&P 500 valuation dispersion of forward P/E (std. dev / avg) vs. rel. perf. of Russell 1000 Growth over Value (1990--4/2023)



Source: FactSet, BofA US Equity & Quant Strategy

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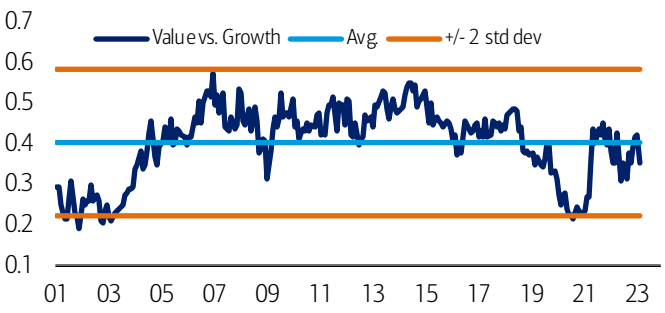
Exhibit 21: P/E trades at historic average vs L-T EPS Growth
Relative Fwd P/E of Value (Forward P/E) vs Growth (Long-Term EPS Growth), 2/01 – 4/23



Source: FactSet, BofA US Equity & Quant Strategy

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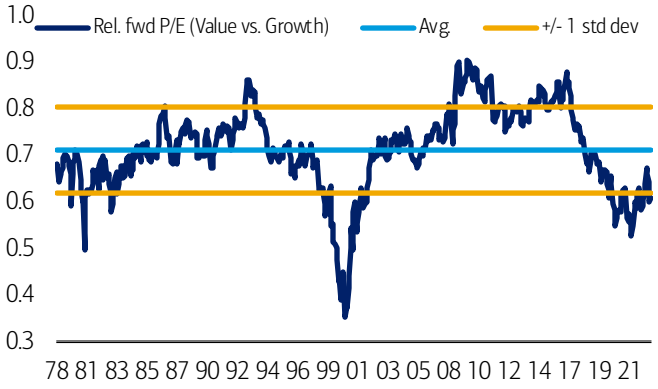
Exhibit 22: Value vs. Growth valuations dipped more than 1 St. Dev. below the historic average
Relative forward P/E of Russell 1000 Value vs. Growth indices, 1978-4/30/23



Source: FactSet, BofA US Equity & Quant Strategy

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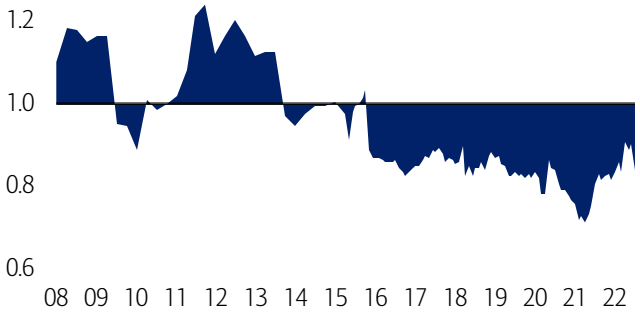
- More room for Value to re-rate: the relative forward P/E of Value vs. Growth has re-rated recently, but remains below historic average.

Exhibit 23: Value has a deep underweight at the sector level (Fins vs TMT)...
Long-only relative positioning to S&P 500, ratio of Financials vs Comm. Svcs. (9/2008-4/2023)



Source: BofA Global Research estimates

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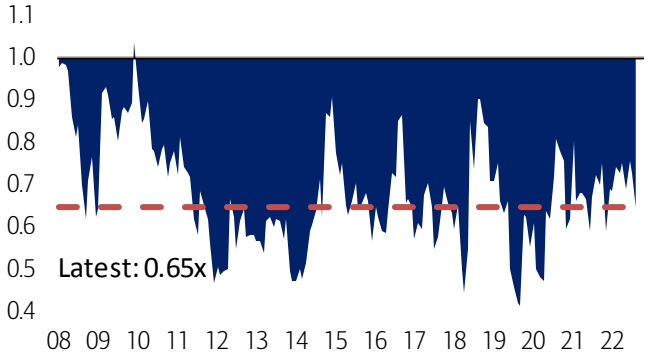
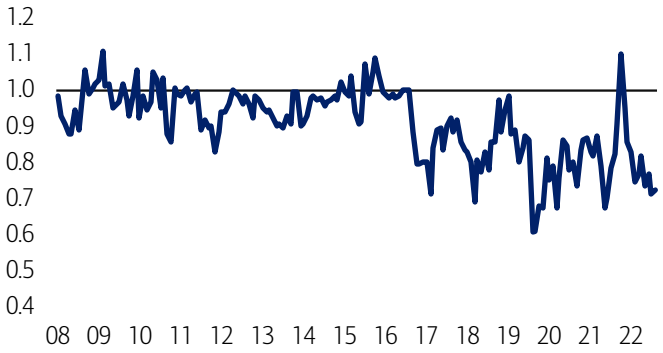
Exhibit 24: ...and factor level (Low P/E vs High LTG)
Long Only Positioning in Value vs Growth proxied by Low P/E vs High Long-Term Growth Deciles of S&P 500 (9/2008-4/2023)



Source: BofA US Equity & Quant Strategy, FactSet Ownership

BofA GLOBAL RESEARCH

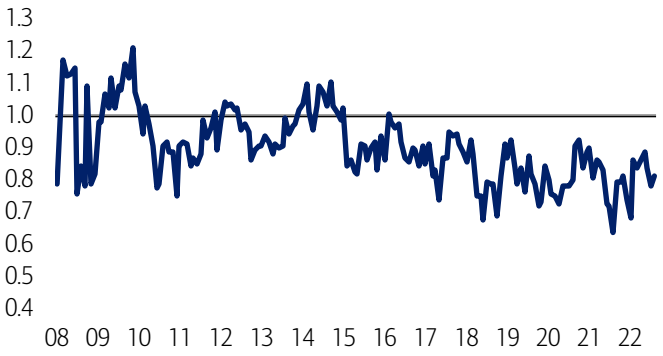
Exhibit 25: High Fwd EPS Yield (Low Fwd P/E) is underowned by Fund Managers
High EPS Yield – Weight in Mutual Funds (9/2008-4/2023)



Source: BofA US Equity & Quant Strategy, FactSet Ownership

BofA GLOBAL RESEARCH

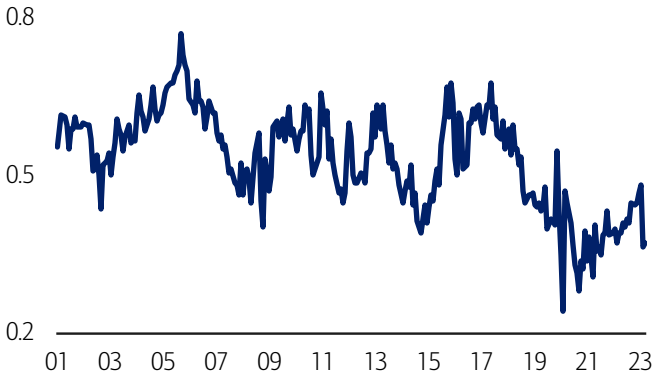
Exhibit 26: High FCF/EV is underowned by Fund Managers
High FCF/EV – Weight in Mutual Funds (9/2008-4/2023)



Source: BofA US Equity & Quant Strategy, FactSet Ownership

BofA GLOBAL RESEARCH

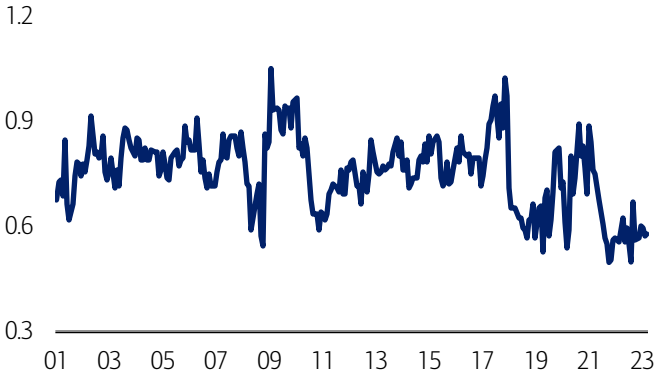
Exhibit 27: High Fwd EPS Yield (Low P/E) trades below historical average
Valuations: Relative Price to Book Value (2/01 – 4/23)



Source: FactSet, BofA US Equity & Quant Strategy

BofA GLOBAL RESEARCH

Exhibit 28: FCF/EV trades below historical average
Valuations: Relative Price to Book Value (2/01 – 4/23)



Source: FactSet, BofA US Equity & Quant Strategy

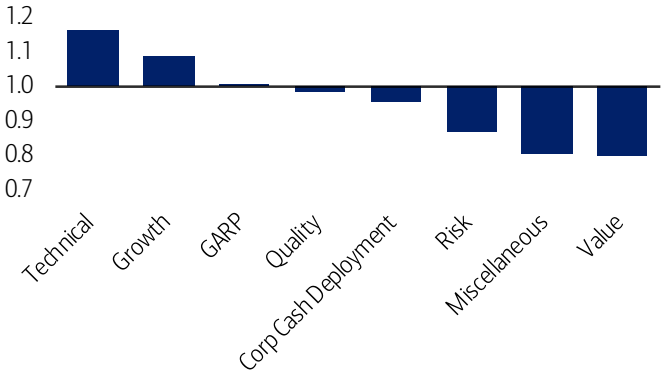
BofA GLOBAL RESEARCH

Exhibit 29: Share Repurchase factor trades near historic low valuations
Valuations: Price to Book Value (2/01 – 4/23)

Source: FactSet, BofA US Equity & Quant Strategy

BofA GLOBAL RESEARCH

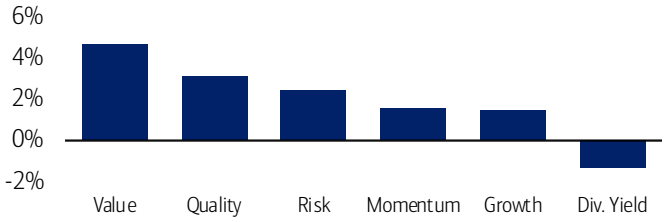
Exhibit 30: Value remains deeply underweight by active managers
Relative Weight in Mutual Fund holdings (Apr. 2023)



Source: BofA US Equity & Quant Strategy, FactSet Ownership

BofA GLOBAL RESEARCH

Exhibit 31: Factor performance during periods of above average interest rates volatility
Value fared best when volatility was elevated (1990 – present annualized relative performance vs equal weighted index).



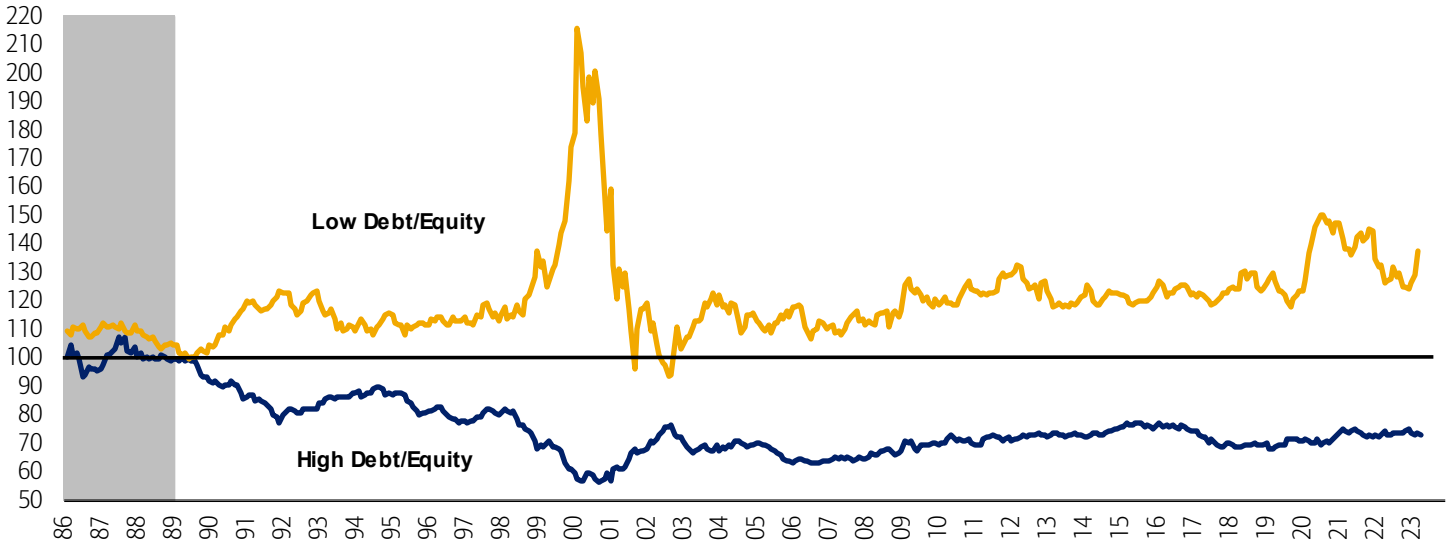
Source: FactSet, BofA US Equity & Quant Strategy

BofA GLOBAL RESEARCH

- Interestingly, during periods of above-average interest rate volatility based on big upward or downward daily moves in the 10-yr Treasury yield, Value factors led by the widest margin (4.6ppt vs. the equal-wtd. S&P 500 index).

Exhibit 32: BofA Quantitative Strategy Financial Confidence indicator (back tested results from month end March 1986 to month end December1988)

Low Debt / Equity companies outperformed the equal weighted S&P 500 index in YTD



Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end December1988. The unshaded portion represents actual performance since January 1989. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein.

BofA GLOBAL RESEARCH

Exhibit 33: Value vs. Secular growth: high EPS yield vs. high 5-yr projected EPS growth

Growth has outperformed Value YTD (Back tested results from month end March 1986 to month end December 1988)

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end December 1988. The unshaded portion represents actual performance since January 1989. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein.

BofA GLOBAL RESEARCH

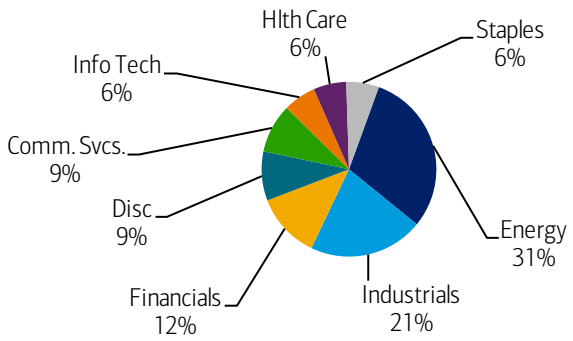
Screens and Performance data are available in Research Library Excel format.

Dividend Discount Model Alpha

Top S&P 500 Companies By High DDM Alpha

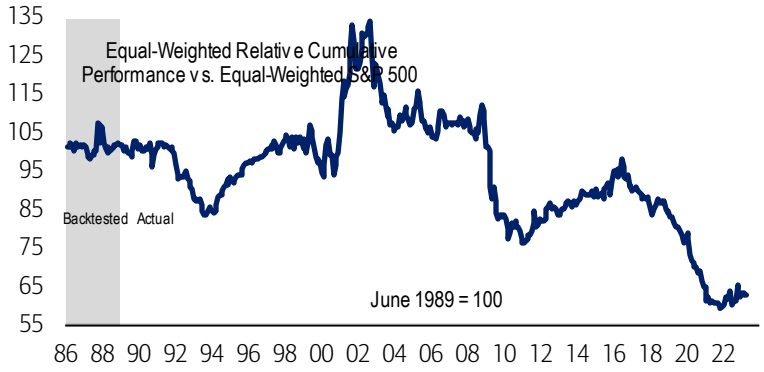
Dividend Discount Model Alpha: The implied return from the BofA Quantitative Strategy three-stage dividend discount model less the required return from a Capital Asset Pricing Model. Presented as a decile rank.

Sector weights of Dividend Discount Model Top Decile
The factor has the highest weight in Energy (31%)



BofA GLOBAL RESEARCH

Dividend Discount Model Top Decile: Relative cumulative performance
The factor outperformed the index in April



BofA GLOBAL RESEARCH

Table 1: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**0.15%**
Last 3 Months	-5.83%
Last 6 Months	-0.25%
Last 12 Months	-0.41%
2023 YTD	3.25%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end December 1988. The unshaded portion represents actual performance since January 1989. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

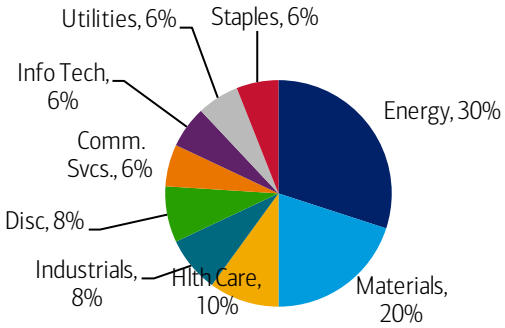
BofA GLOBAL RESEARCH

Price/Cash Flow

Top Decile S&P 500 (ex. Financials) Companies By Low Price /Cash Flow

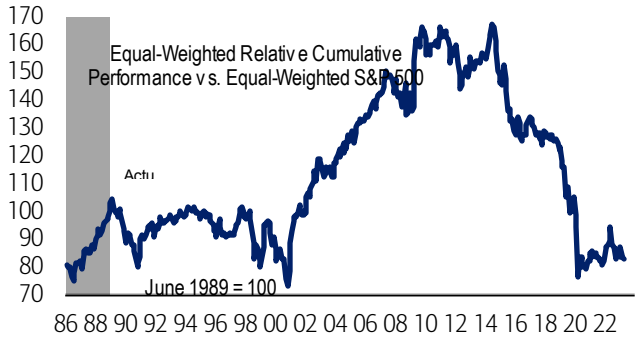
Price/Cash Flow: Month-end price divided by latest reported cash flow. Cash flow is defined as earnings post extraordinary items plus depreciation.

Sector weights of Price/Cash Flow-Top Decile
The factor has the highest weight in Energy (30%)



BofA GLOBAL RESEARCH

Price/Cash Flow Top Decile: Relative cumulative performance
The factor underperformed the index in April



BofA GLOBAL RESEARCH

Table 2: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**-1.03%**
Last 3 Months	-8.99%
Last 6 Months	-0.13%
Last 12 Months	-8.18%
2023 YTD	1.58%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end December 1988. The unshaded portion represents actual performance since January 1989. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

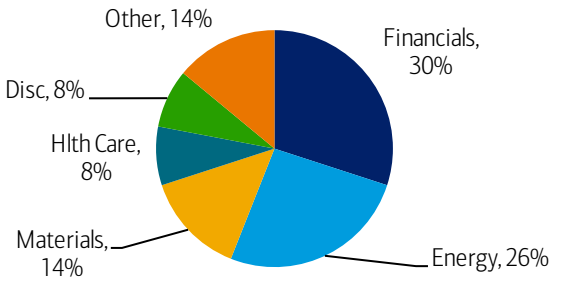
BofA GLOBAL RESEARCH

Earnings Yield

Top Decile S&P 500 Companies By High Earnings Yield

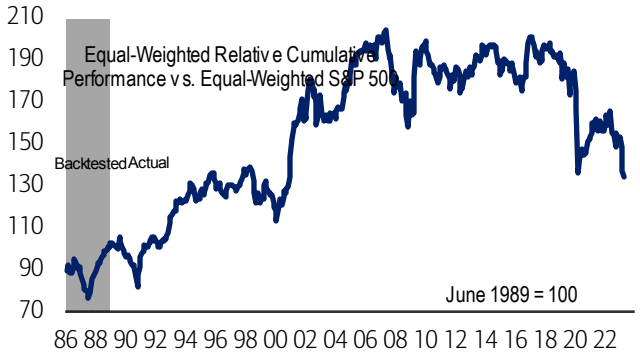
Earnings Yield: Trailing 12-month EPS divided by month-end price.

Sector weights of Earnings Yield Model Top Decile
The factor has the highest weight in Financials (30%)



BofA GLOBAL RESEARCH

Earnings Yield Model Top Decile: Relative cumulative performance
The factor underperformed the index in April



BofA GLOBAL RESEARCH

Table 3: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**-2.18%**
Last 3 Months	-16.26%
Last 6 Months	-9.77%
Last 12 Months	-17.05%
2023 YTD	-7.64%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end December 1988. The unshaded portion represents actual performance since January 1989. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

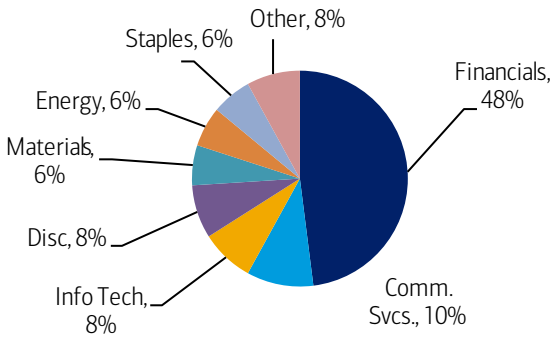
BofA GLOBAL RESEARCH

Price/Book Value

Top Decile S&P 500 Companies By Low Price to Book

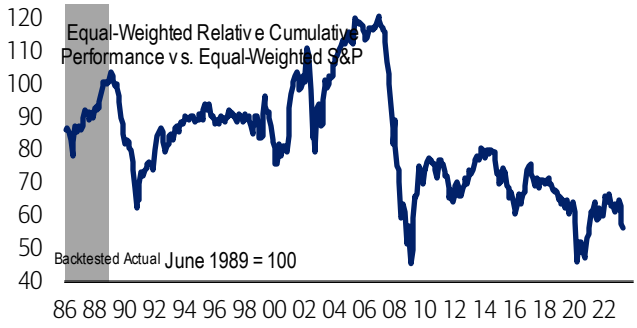
Price/Book Value: Month-end price divided by latest reported book value per share.

Sector weights of Price/Book Top Decile
The factor has the highest weight in Financials (48%)



BofA GLOBAL RESEARCH

Price/Book Top Decile: Relative cumulative performance
The factor underperformed the index in April



BofA GLOBAL RESEARCH

Table 4: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**-1.94%**
Last 3 Months	-16.37%
Last 6 Months	-7.39%
Last 12 Months	-12.94%
2023 YTD	-5.66%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end December 1988. The unshaded portion represents actual performance since January 1989. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

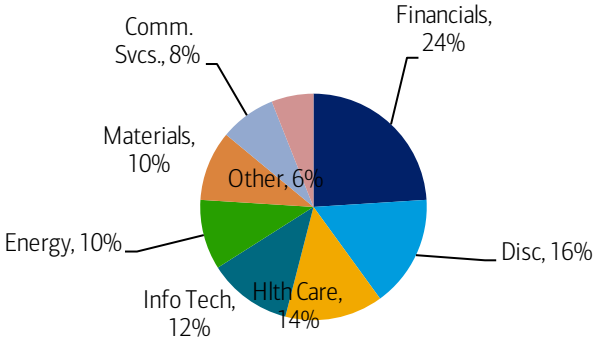
BofA GLOBAL RESEARCH

Forward Earnings Yield

Top Decile S&P 500 Companies By High Forward Earnings Yield

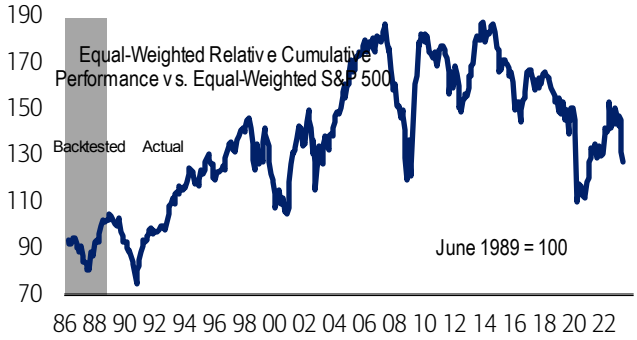
Earnings Yield: Rolling 12-month Forward EPS divided by month-end price.

Sector weights of Forward Earnings Yield Model Top Decile
The factor has the highest weight in Financials (24%)



BofA GLOBAL RESEARCH

Forward Earnings Yield Top Decile: Relative cumulative performance
The factor has recently outperformed the index



BofA GLOBAL RESEARCH

Table 5: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**-2.95%**
Last 3 Months	-17.24%
Last 6 Months	-12.05%
Last 12 Months	-11.73%
2023 YTD	-8.54%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end December 1988. The unshaded portion represents actual performance since January 1989. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

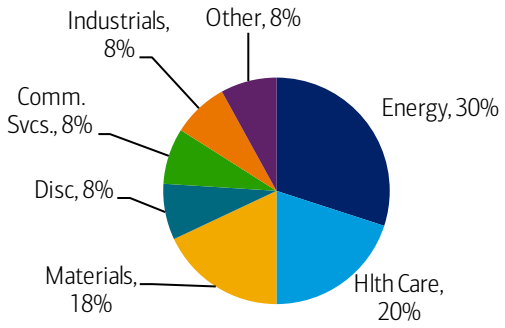
BofA GLOBAL RESEARCH

Price/Free Cash Flow

Top Decile S&P 500 (ex. Financials) Companies By LOW PRICE/FREE CASH FLOW

Price/Free Cash Flow: Month-end price divided by latest reported free cash flow. Free Cash Flow is defined as the earnings after extraordinary items plus depreciation minus capital expenditures.

Sector weights of Price to FCF Top Decile
The factor has the highest weight in Energy (30%)



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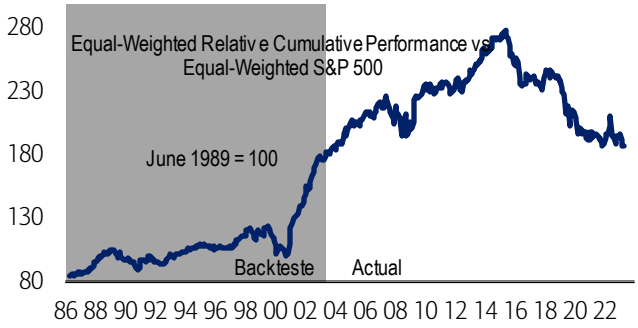
Price to FCF Top Decile: Relative cumulative performance
The factor led the index in April



BofA GLOBAL RESEARCH

Table 6: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**0.19%**
Last 3 Months	-8.50%
Last 6 Months	-0.31%
Last 12 Months	-9.11%
2023 YTD	-0.35%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end July 2003. The unshaded portion represents actual performance since August 2003. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

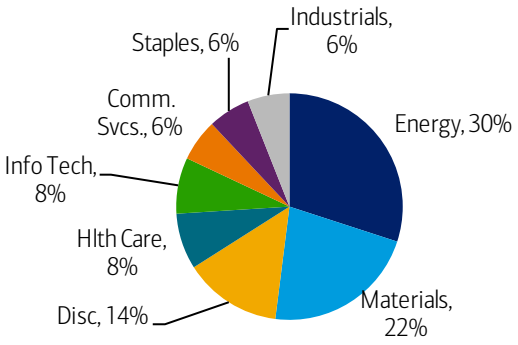
BofA GLOBAL RESEARCH

EV / EBITDA

Top Decile S&P Industrials Companies By LOW EV/EBITDA

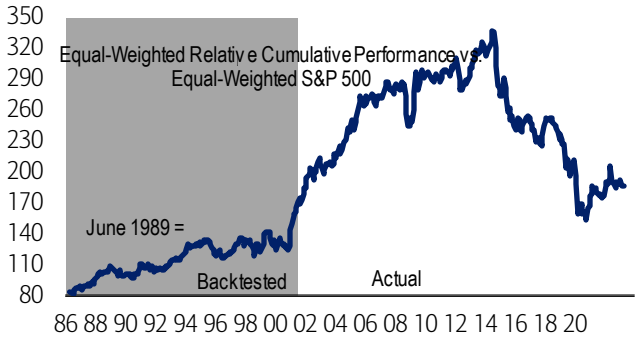
EV/EBITDA: Enterprise Value (Equity Market Capitalization + Long Term Debt + Short Term Debt + Preferred Stock + Minority Interest – Cash & Cash Equivalents) divided by the latest 4-quarter EBITDA.

Sector weights of EV/EBITDA Top Decile
The factor has the highest weight in Energy (30%)



BofA GLOBAL RESEARCH

EV/EBITDA Top Decile: Relative cumulative performance
The factor outperformed the index in April



BofA GLOBAL RESEARCH

Table 7: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**-0.38%**
Last 3 Months	-7.32%
Last 6 Months	1.48%
Last 12 Months	-5.41%
2023 YTD	1.36%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end September 2001. The unshaded portion represents actual performance since January 2005. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

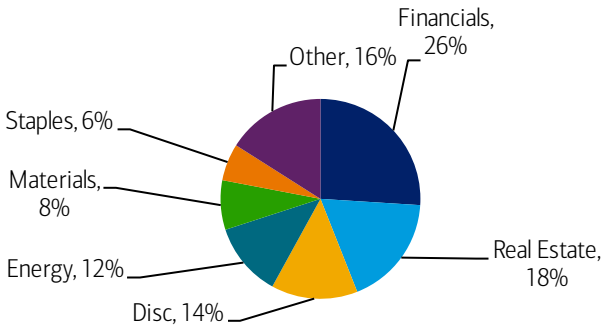
BofA GLOBAL RESEARCH

Dividend Yield

Top Decile S&P 500 Companies By DIVIDEND YIELD

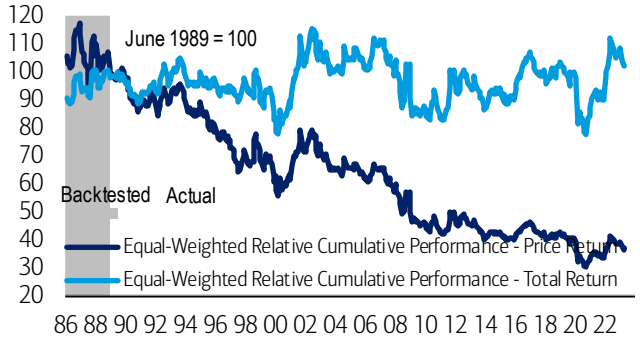
Dividend Yield: Indicated dividend divided by month-end price.

Sector weights of Dividend Yield Top Decile
The factor has the highest weight in Financials (26%)



BofA GLOBAL RESEARCH

Dividend Yield Top Decile: Relative cumulative performance
The factor outperformed the index in April



BofA GLOBAL RESEARCH

Table 8: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**0.30%**
Last 3 Months	-10.42%
Last 6 Months	-1.17%
Last 12 Months	-9.07%
2023 YTD	-2.38%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end December 1988. The unshaded portion represents actual performance since January 1989. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

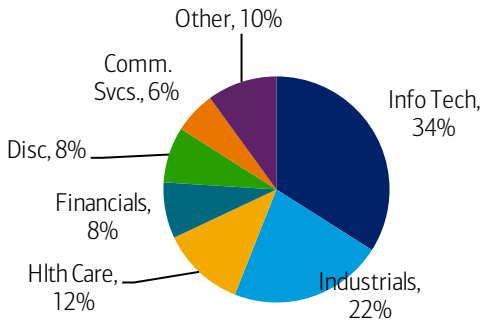
BofA GLOBAL RESEARCH

Five-Year Return on Equity (Adjusted by Debt)

Top Decile S&P 500 Companies By ROE (5-Yr Avg. Adj. for Debt)

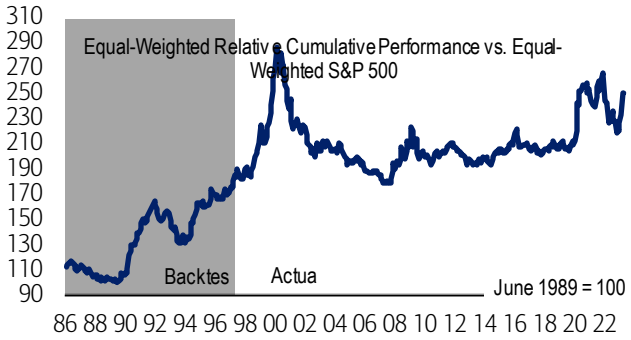
Return on Equity Five-year Average (Adjusted for Debt): The average five year ROE of companies with higher debt levels are considered lower than those of companies with lower debt levels based on their debt-to-equity ratios.

Sector weights of ROE 5 year (Adj. for Debt) Top Decile
The factor has the highest weight in Tech (34%)



BofA GLOBAL RESEARCH

ROE 5 year (Adj. for Debt) Top Decile: Relative cumulative performance
The factor underperformed the index in April



BofA GLOBAL RESEARCH

Exhibit 34: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**-0.39%**
Last 3 Months	5.19%
Last 6 Months	18.73%
Last 12 Months	8.79%
2023 YTD	16.34%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end April 1997. The unshaded portion represents actual performance since May 1997. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

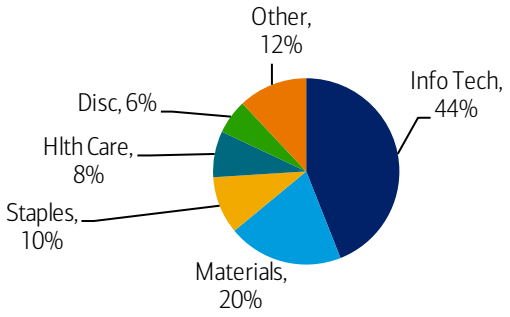
BofA GLOBAL RESEARCH

Foreign Exposure

Top Decile S&P 500 Companies By FOREIGN EXPOSURE

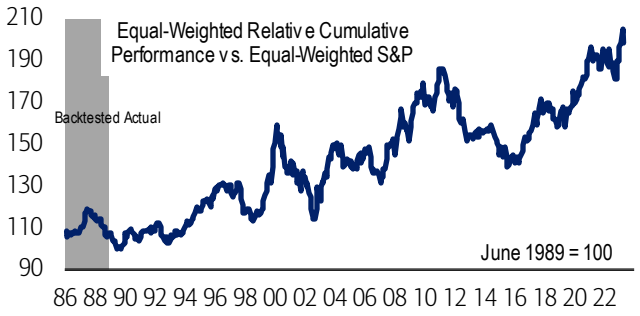
Foreign Exposure: The ratio of foreign sales to total sales.

Sector weights of Foreign Exposure Top Decile
The factor has the highest weight in Tech (44%)



BofA GLOBAL RESEARCH

Foreign Exposure Top Decile: Relative cumulative performance
The factor underperformed the index in April



BofA GLOBAL RESEARCH

Table 9: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**-3.31%**
Last 3 Months	-3.45%
Last 6 Months	14.03%
Last 12 Months	4.62%
2023 YTD	7.15%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet
The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end December 1988. The unshaded portion represents actual performance since January 1989. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

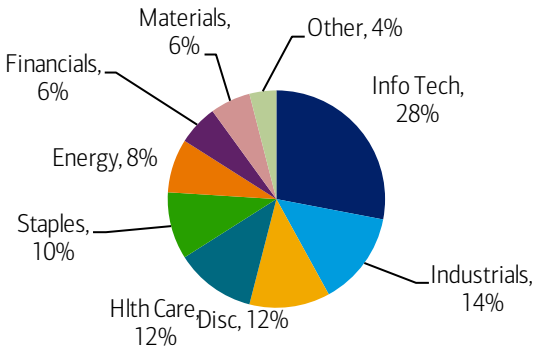
BofA GLOBAL RESEARCH

One-Year Return on Equity

Top Decile S&P 500 Companies By ROE (1-Yr Average)

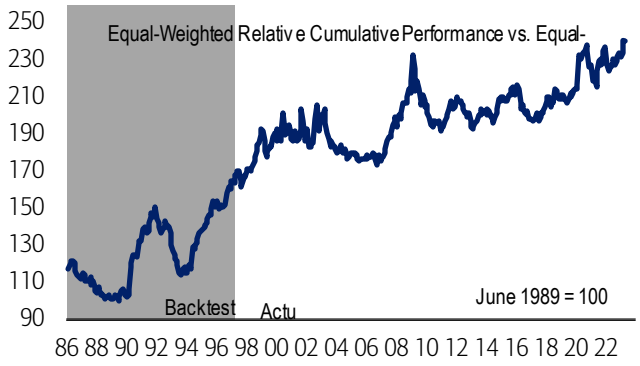
Return on Equity One-Year Average: Net income divided by average equity provided.

Sector weights of ROE Top Decile
The factor has the highest weight in Tech (28%)



BofA GLOBAL RESEARCH

ROE Top Decile: Relative cumulative performance
The factor underperformed the index in April



BofA GLOBAL RESEARCH

Table 10: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**-0.20%**
Last 3 Months	-0.85%
Last 6 Months	7.66%
Last 12 Months	4.01%
2023 YTD	5.97%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end April 1997. The unshaded portion represents actual performance since May 1997. Back Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

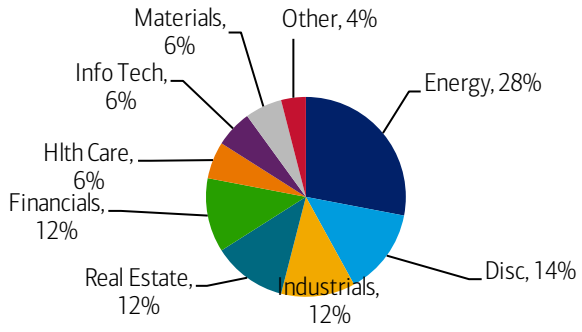
BofA GLOBAL RESEARCH

Dividend Growth

Top Decile S&P 500 Companies By Dividend Growth

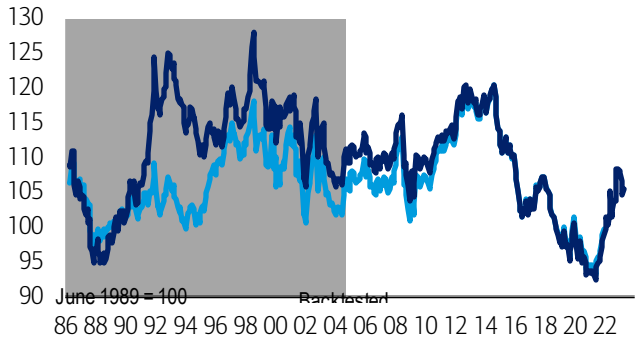
Dividend Growth: The growth between trailing 4-quarter total common dividends and year-ago trailing 4-quarter total common dividends.

Sector weights of Dividend Growth Top Decile
The factor has the highest weight in Industrials (24%)



BofA GLOBAL RESEARCH

Dividend Growth Top Decile: Relative cumulative performance
The factor outperformed the index in April



BofA GLOBAL RESEARCH

Table 11: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**0.87%**
Last 3 Months	-6.58%
Last 6 Months	1.17%
Last 12 Months	1.96%
2023 YTD	0.08%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end Mary 1986 to month end December 2004. The unshaded portion represents actual performance since January 2005. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

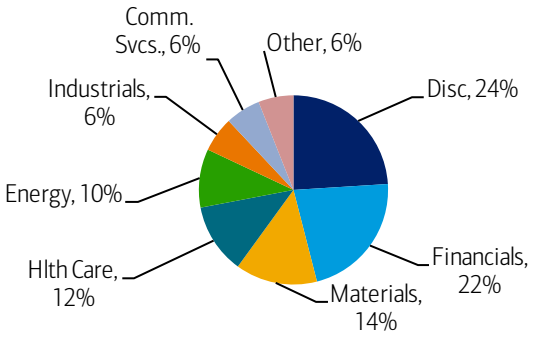
BofA GLOBAL RESEARCH

Share Repurchase

Top Decile S&P 500 Companies By Large Share Repurchase

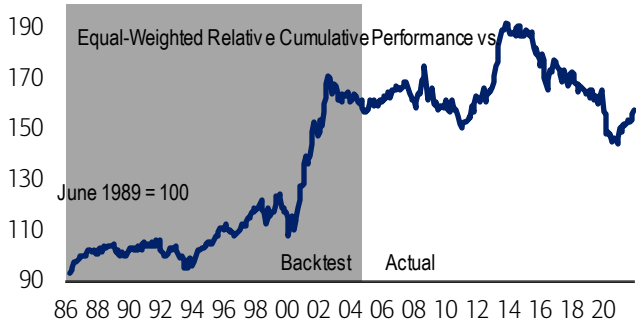
Share Repurchase: The year-to-year change in shares outstanding.

Sector weights of Share Repurchase Top Decile
The factor has the highest weight in Disc (24%)



BofA GLOBAL RESEARCH

Share Repurchase Top Decile: Relative cumulative performance
The factor outperformed the index in recent April



BofA GLOBAL RESEARCH

Table 12: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**1.35%**
Last 3 Months	-4.90%
Last 6 Months	6.63%
Last 12 Months	1.22%
2023 YTD	5.63%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end December 2004. The unshaded portion represents actual performance since January 2005. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

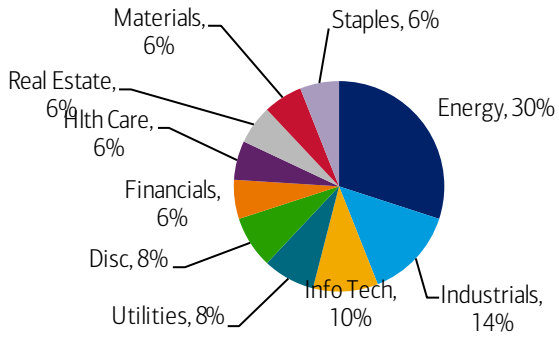
BofA GLOBAL RESEARCH

Earnings Momentum

Top Decile S&P 500 Companies By EPS MOMENTUM

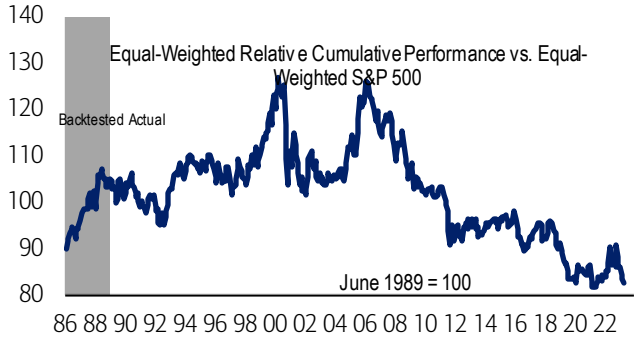
Earnings Momentum: The difference between 12-month trailing EPS and year-ago 12-month trailing EPS divided by year-ago 12-month trailing EPS.

Sector weights of Earnings Momentum Top Decile
The factor has the highest weight in Energy (30%)



BofA GLOBAL RESEARCH

Earnings Momentum Top Decile: Relative cumulative performance
The factor has underperformed the index in recent years



BofA GLOBAL RESEARCH

Table 13: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**-0.73%**
Last 3 Months	-7.94%
Last 6 Months	-5.38%
Last 12 Months	-6.17%
2023 YTD	-1.21%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end December 1988. The unshaded portion represents actual performance since January 1989. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

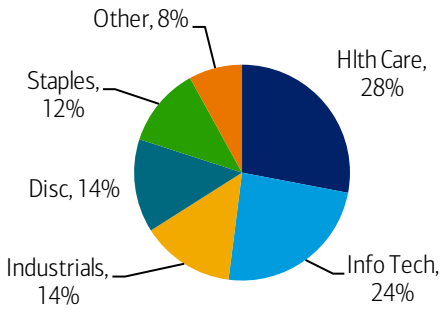
BofA GLOBAL RESEARCH

Equity Duration

Top Decile S&P 500 Companies By HIGH DURATION

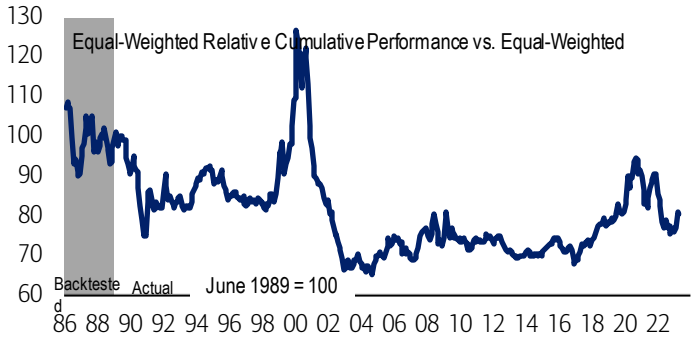
Equity Duration: An adaptation of our Dividend Discount Model that measures the interest-rate sensitivity of a stock. Longer duration (higher numbers) suggests more interest-rate sensitivity.

Sector weights of Duration Top Decile
The factor has the highest weight in Health Care (28%)



BofA GLOBAL RESEARCH

Duration Top Decile: Relative cumulative performance
The factor has underperformed the index in April



BofA GLOBAL RESEARCH

Table 14: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**-0.42%**
Last 3 Months	1.58%
Last 6 Months	11.61%
Last 12 Months	1.16%
2023 YTD	7.81%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end December 1988. The unshaded portion represents actual performance since January 1989. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

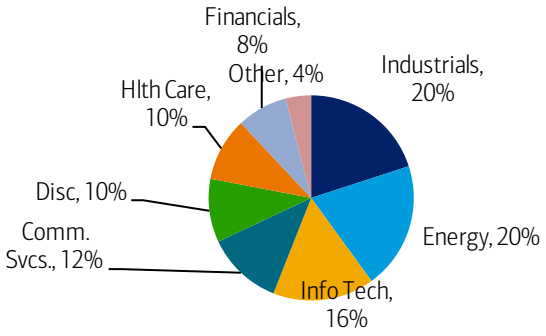
BofA GLOBAL RESEARCH

Projected Five-Year EPS Growth

Top Decile S&P 500 Companies By PROJ. 5-YR EPS GROWTH

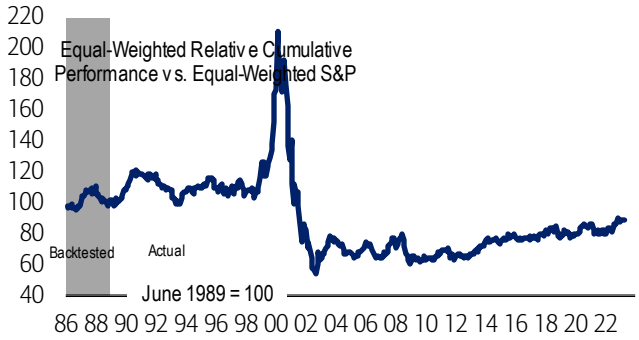
Projected 5-Year EPS Growth: The five-year EPS growth rate estimated by BofA Fundamental Equity Research. If no BofA estimate exists, then the IBES Mean Long Term Growth Estimate is used.

Sector weights of Proj. 5 Year EPS Growth Top Decile
The factor has the highest weight in Industrials (20%)



BofA GLOBAL RESEARCH

Proj. 5 Year EPS Growth Top Decile: Relative cumulative performance
The factor underperformed the index in April



BofA GLOBAL RESEARCH

Table 15: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**-0.49%**
Last 3 Months	-5.22%
Last 6 Months	1.31%
Last 12 Months	5.06%
2023 YTD	2.94%

BofA GLOBAL RESEARCH

Source: BofA US Equity and Quant Strategy, FactSet
The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end December 1988. The unshaded portion represents actual performance since January 1989. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

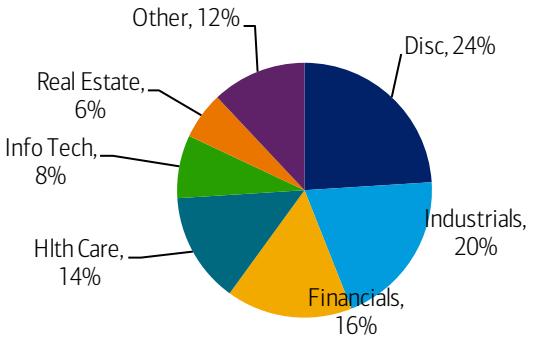
BofA GLOBAL RESEARCH

Size

Top Decile S&P 500 Companies By SMALL SIZE

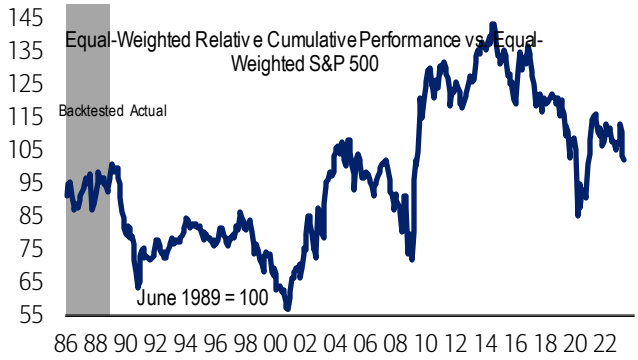
Firm Size: Month-end market value.

Sector weights of Small size Top Decile
The factor has the highest weight in Disc (24%)



BofA GLOBAL RESEARCH

Small Size Top Decile: Relative cumulative performance
The factor has outperformed the index in recent months



BofA GLOBAL RESEARCH

Table 16: Absolute Returns
Factor performance over 1m, 3m, 6m, 12m and YTD

Last 1 Month	**-1.10%**
Last 3 Months	-13.55%
Last 6 Months	-0.33%
Last 12 Months	-10.01%
2023 YTD	-2.03%

BofA GLOBAL RESEARCH

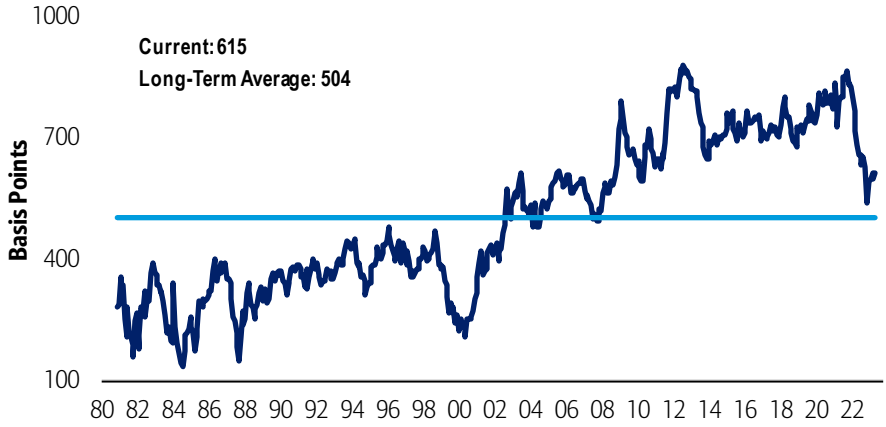
Source: BofA US Equity and Quant Strategy, FactSet

The shaded area in performance chart shows back tested results during the period from month end March 1986 to month end December 1988. The unshaded portion represents actual performance since January 1989. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions.

BofA GLOBAL RESEARCH

Valuation Backdrop

Exhibit 35: S&P 500 Risk Premium rose in recent months
S&P 500 Risk Premium (DDM Expected Return less AAA Corporate Bond Rate)

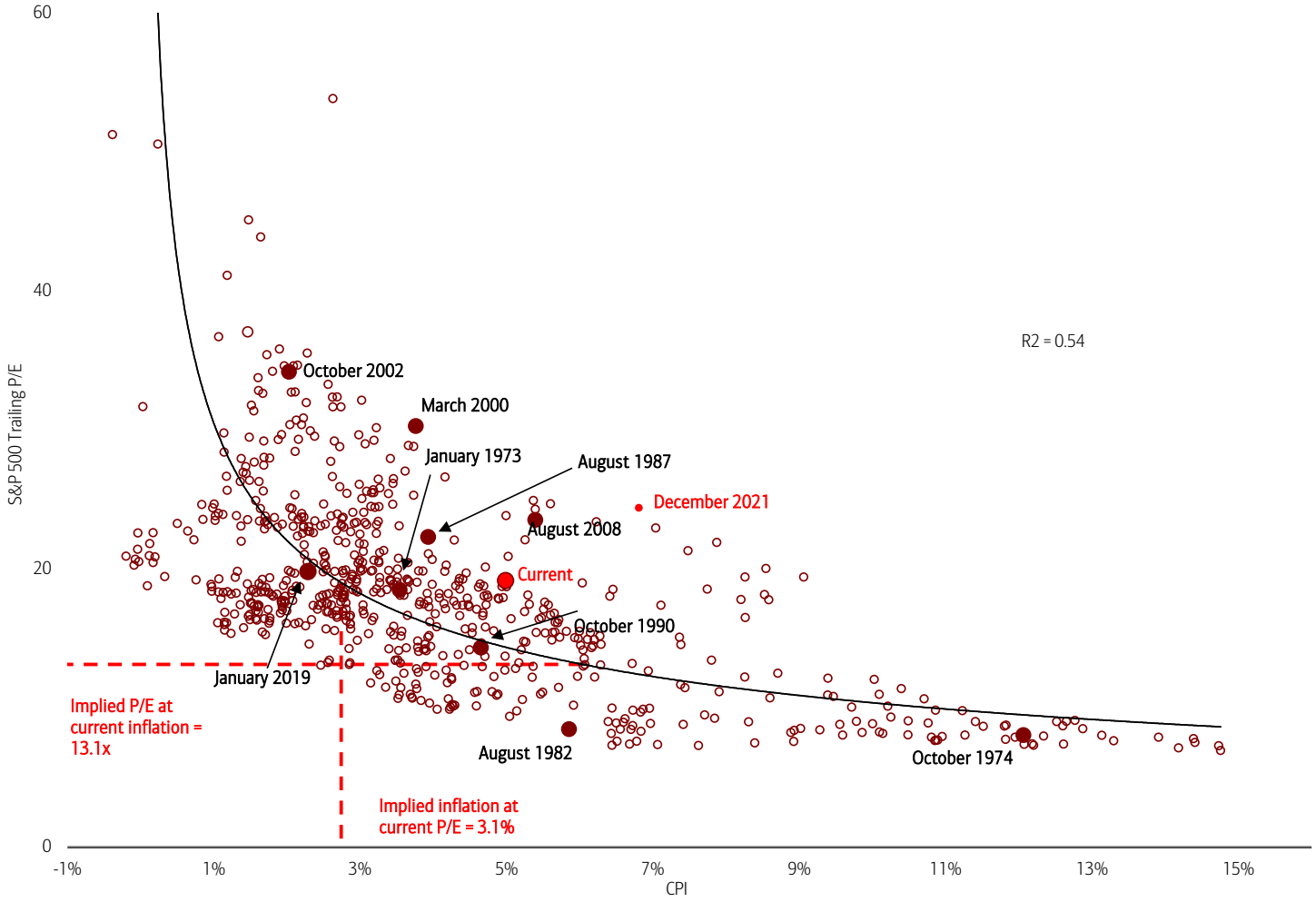


Source: BofA US Equity and Quant Strategy, FactSet

BofA GLOBAL RESEARCH

Note: In the chart below we exclude deflationary points from trend line calculation. Historically, the relationship between inflation and valuation breaks down during deflationary periods. For example, from 1949 to1950, S&P 500 valuation was below average, and from 1954 to 1955, valuation was well above average.

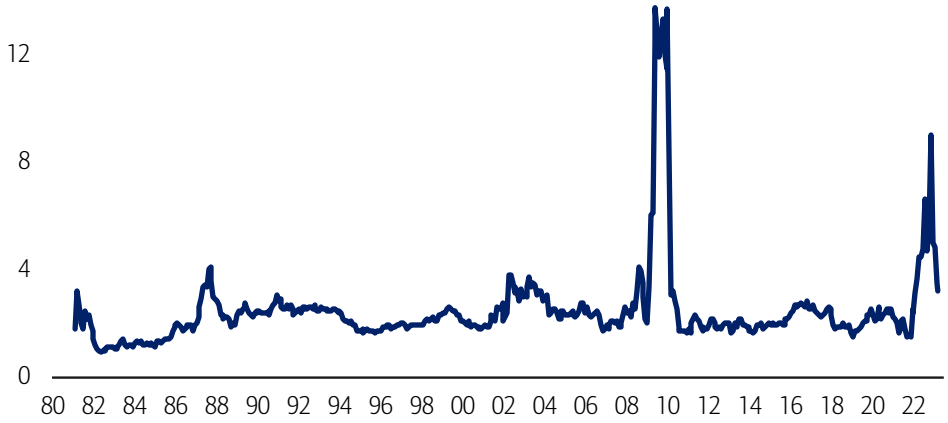
Exhibit 36: Inflation vs. P/E Model
S&P 500 trailing P/E remains well above the trend line (1965 to 4/30/23)



Source: BofA US Equity and Quant Strategy, FactSet

BofA GLOBAL RESEARCH

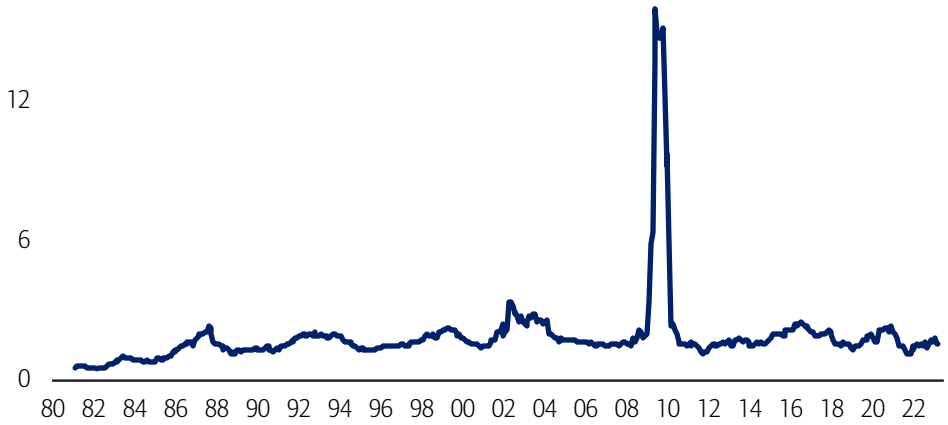
Exhibit 37: S&P 500 Real PE-to-Growth Ratio (Trailing P/E Divided by Proj. 5-Yr EPS Growth less Inflation)
Real P/E to Growth ratio rose in recent months (as of 4/30/2023)



Source: BofA US Equity and Quant Strategy, FactSet

BofA GLOBAL RESEARCH

Exhibit 38: S&P 500 PE-to-Growth Ratio (Trailing P/E Divided by Proj. 5-Yr EPS Growth)
P/E to Growth ratio rose in recent months (as of 4/30/2023)



Source: BofA US Equity and Quant Strategy, FactSet

BofA GLOBAL RESEARCH

Exhibit 39: BofA Universe Sector/Industry Factor Evaluation
As of 4/30/2023

	# of Comp	% Univ BofA	Impl. Return	Reqd Return	DDM Alpha	Valuation Analysis Eqty. Duration	BofA Adj ßeta	P/E Ratio	Price/ Book	Yield	Expectation Analysis Surprise	Earnings (Decile) Risk	Torp	Disp	Est. Rev.	PR 5yr Growth	EPS Growth 2023E	2024E
Economic Sectors																		
Energy	72	5.13	17.8	12.6	5.2	16.70	1.26	10.1	2.16	3.8	6	8	3	7	7	26.3	103	-12
Materials	66	2.94	10.1	10.8	-0.7	36.20	1.08	15.1	2.72	2.0	3	6	4	5	5	5.7	52	-21
Industrials	188	8.47	10.5	11.3	-0.8	33.50	1.09	18.3	3.95	1.7	6	4	5	4	5	15.8	12	16
Consumer Discretionary	199	11.02	9.6	12.2	-2.6	41.60	1.20	22.6	4.76	0.9	4	5	6	5	6	14.1	33	13
Consumer Staples	60	6.93	9.5	8.5	1	36.90	0.73	21.1	5.47	2.4	7	5	4	2	5	8.0	4	3
Health Care	273	14.46	10.6	9.1	1.5	35.00	0.81	21.3	3.72	1.5	5	6	4	3	5	11.1	-13	-3
Financials	169	10.61	11.4	11.1	0.3	30.70	1.06	12.6	1.87	2.4	7	4	6	4	5	12.0	60	9
Information Technology	168	24.95	10.0	11.9	-1.9	39.20	1.14	25.2	8.26	0.9	5	4	4	4	5	14.8	8	0
Communication Services	53	9.67	13.0	11.2	1.8	27.70	1.05	13.9	3.52	0.7	2	4	7	6	4	18.3	17	18
Utilities	59	2.98	9.8	8.3	1.5	32.20	0.71	18.3	2.05	3.3	6	4	5	2	5	7.2	39	13
Real Estate	94	2.84	10.1	10.1	0	31.10	0.92	17.5	2.24	3.9	6	5	4	2	7	6.4	49	9
Capitalization Sectors ($ Million)																		
19 To 1376	281	0.43	12.0	12.7	-0.7	25.10	1.21	nm	1.15	1.7	5	7	6	7	6	25.1	-13	47
1377 To 3694	280	1.76	11.5	12.0	-0.5	28.60	1.18	19.3	1.81	2.2	5	6	6	6	6	19.5	-9	16
3743 To 9011	280	4.19	11.5	12.1	-0.6	29.80	1.20	13.1	1.92	1.7	5	5	5	5	6	19.2	65	4
9026 To 27032	280	11.10	11.2	11.0	0.2	31.80	1.06	16.3	2.55	1.9	6	5	5	4	5	15.3	20	1
27346 To 2523587	280	82.51	10.6	10.9	-0.3	35.30	1.02	18.6	4.34	1.6	5	5	5	4	5	13.1	11	1
Risk Sectors																		
-3.12 To 0.83	258	22.82	10.1	8.1	2	33.40	0.69	17.7	3.18	2.5	6	5	5	3	5	9.6	-4	2
0.84 To 1.03	264	23.55	10.1	10.2	-0.1	37.40	0.94	20.6	4.51	1.6	5	4	5	3	5	10.6	12	9
1.04 To 1.18	248	26.42	11.4	11.5	-0.1	33.20	1.10	16.3	3.55	1.3	5	5	6	5	5	15.2	18	3
1.19 To 1.40	253	18.61	10.8	12.7	-1.9	35.00	1.25	17.4	3.89	1.3	6	4	4	4	6	14.7	13	-7
1.41 To 3.36	256	7.66	11.4	15.7	-4.3	34.40	1.62	20.3	3.59	1.1	5	6	5	7	6	26.0	171	31
Uncoded	122	0.95	11.4			30.30		58.4	2.32	0.7	6	9	6	7	5	37.1	100	174
DDM Alpha																		
Most Undervalued	170	7.29	18.0	11.6	6.4	16.50	1.11	12.8	2.37	2.2	6	8	5	7	6	50.4	nm	2
Undervalued	170	20.03	12.2	9.7	2.5	28.90	0.88	14.7	2.93	1.8	4	5	6	4	4	14.2	12	6
Fair Value	170	19.31	10.8	10.2	0.6	33.10	0.94	17.8	4.34	1.8	6	5	5	3	4	11.7	15	9
Overvalued	170	19.85	9.8	10.9	-1.1	38.40	1.02	20.5	4.19	1.5	5	4	5	3	5	9.7	12	8
Most Overvalued	170	20.35	9.1	12.9	-3.8	44.90	1.28	26.5	7.83	0.7	5	4	5	4	6	11.5	7	-1
Uncoded	551	13.16	11.4	-23.2	34.6	30.30	1.01	17.2	2.25	2.5	6	5	4	5	6	3.1	9	-19

Source: BofA US Equity and Quant Strategy, FactSet

Exhibit 40: BofA Universe Sector/Industry Factor Evaluation (cont'd)
As of 4/30/2023

	# of Comp	% Univ BofA	Valuation Analysis: Impl. Return	Reqd Return	DDM Alpha	Eqty. Duration	BofA Adj ßeta	P/E Ratio	Price/ Book	Yield	Expectation Analysis: Surprise	Earnings (Decile) Risk	Torp	Disp	Est. Rev.	PR 5yr Growth	EPS Growth 2023E	2024E
Duration																		
3.04 To 19.18	185	7.76	16.7	12.0	4.7	15.80	1.16	11.8	2.10	2.8	6	8	5	7	6	47.2	nm	-1
19.26 To 27.21	185	9.18	14.1	11.7	2.4	23.40	1.12	12.3	2.31	2.2	5	5	6	5	4	18.7	13	6
27.24 To 32.74	185	21.27	11.7	10.5	1.2	29.90	0.98	16	3.66	1.6	4	5	6	4	4	13.9	17	10
32.76 To 39.24	185	19.66	10.0	10.3	-0.3	35.80	0.96	20.1	4.06	1.8	6	4	5	3	4	10.6	17	4
39.25 To 82.14	185	29.73	8.8	11.3	-2.5	45.70	1.08	27.9	8.29	0.7	5	4	4	3	5	9.9	7	3
Uncoded	476	12.41					1.01	17	2.23	2.6	6	5	4	5	6	0.2	9	-19
Growth Sectors																		
Growth	638	39.89	10.7	11.2	-0.5	36.30	1.07	22.1	5.06	0.9	4	4	6	4	5	16.8	17	11
Growth Cyclical	252	23.32	10.4	11.9	-1.5	37.00	1.14	20.9	5.37	1.3	6	4	4	4	5	14.1	9	-1
Growth Defensive	127	12.82	10.0	9.3	0.7	34.80	0.83	18.1	3.46	2.5	6	5	5	3	6	8.0	6	0
Cyclical	244	11.75	11.6	12.0	-0.4	28.80	1.17	11.3	1.84	2.4	6	6	5	5	5	11.0	20	-7
Defensive	140	12.22	11.0	9.3	1.7	29.70	0.82	14.5	2.26	3.1	6	6	4	3	5	11.7	35	-4
EPS Surprise																		
Most Optimistic	257	28.07	10.6	10.9	-0.3	36.60	1.04	18.7	5.10	1.0	1	4	6	4	5	14.4	10	9
Optimistic	257	12.20	10.9	11.3	-0.4	31.00	1.07	15.6	2.92	1.9	4	5	5	4	5	14.4	19	7
Neutral	257	18.16	10.8	10.8	0	32.80	1.01	17.2	3.32	2.1	5	5	5	4	5	11.9	18	-7
Less Optimistic	257	23.95	10.3	11.4	-1.1	37.30	1.08	22.6	5.61	1.3	7	4	5	3	5	13.3	10	-2
Not Optimistic	257	13.86	11.7	10.9	0.8	29.20	1.01	14.5	2.04	2.7	9	5	5	4	5	13.4	14	2
Uncoded	116	3.76	8.5	8.1	0.4	43.10	0.84	24.3	3.57	2.2		6	5	4	6	20.1	-24	31
Quality Rank																		
A+	28	7.15	10.2	10.4	-0.2	35.70	0.96	21.1	7.10	1.4	4	2	5	2	5	10.7	17	10
A	68	20.15	9.7	10.9	-1.2	40.20	1.03	25	8.77	1.1	5	3	4	3	5	12.5	9	2
A-	103	14.26	10.4	10.6	-0.2	34.90	0.97	17.7	3.30	2.2	6	5	5	4	5	10.1	10	4
B+	208	24.78	11.0	10.5	0.5	32.70	0.97	16	3.71	1.8	5	5	5	3	5	10.5	13	5
B	175	14.60	10.7	11.3	-0.6	33.30	1.06	14.3	2.66	2.0	5	6	5	5	5	13.5	-9	-19
B-	160	8.96	12.2	12.5	-0.3	32.30	1.22	14.4	2.66	1.7	5	9	5	6	6	16.6	243	17
C & D	112	2.19	12.0	11.9	0.1	28.40	1.12	24	2.33	0.5	5	9	6	6	6	39.1	-9	16
Not Rated	547	7.91	11.8	11.8	0	29.10	1.17	28.6	2.71	1.4	5	5	6	6	5	29.1	109	10
B+ or Better	407	66.33	10.4	10.7	-0.3	35.90	0.99	19	4.72	1.6	5	4	5	3	5	11.1	11	4
B or Worse	994	33.67	11.5	11.8	-0.3	31.90	1.13	16.7	2.65	1.7	5	7	5	6	5	19.2	25	-6
BofA Universe	1401	100.00	10.7	11.0	-0.3	34.70	1.04	22.5	3.69	1.6						13.7	16	2
S&P 500	503	92.01	10.6	10.9	-0.3	35.10	1.02	22.8	3.77	1.6						12.2	13	1

Source: BofA US Equity and Quant Strategy, FactSet

Exhibit 41: BofA Universe Sector/Industry Factor Evaluation (cont'd)
As of 4/30/2023

			Valuation Analysis									Expectation Analysis						
	# of Comp	% Univ BofAML	Impl. Return	Reqd Return	DDM Alpha	Eqty. Duration	BofAML Adj ßeta	P/E Ratio	Price/ Book	Yield	Surprise	Earnings (Decile) Risk	Torp	Disp	Est. Rev.	PR 5yr Growth	EPS Growth 2023E	2024E
ENERGY	72	5.13	17.8	12.6	5.2	16.7	1.26	10.1	2.16	3.8	6	8	3	7	7	26.30	103	-12
ENERGY EQUIP & SVS	17	0.44	17.5	15.5	2	18.1	1.59	14.3	2.33	1.9	6	8	8	5	5	54.30	75	489
OIL & GAS	55	4.70	17.8	12.3	5.5	16.5	1.23	9.8	2.14	4.0	6	8	3	7	7	23.60	91	-14
MATERIALS	66	2.94	10.1	10.8	-0.7	36.2	1.08	15.1	2.72	2.0	3	6	4	5	5	5.70	52	-21
CHEMICALS	31	1.79	10.2	10.8	-0.6	35.8	1.04	17.0	2.91	2.0	3	5	5	4	6	8.50	68	-25
CONSTR MATERIALS	2	0.12	10.0	9.6	0.4	39.1	0.87	26.0	3.25	0.9	6	1	6	6	7	14.20	nm	nm
CONTAINERS & PCKG	16	0.32	10.8	10.3	0.5	35.4	0.97	13.2	2.50	2.6	7	4	4	4	7	5.40	19	-17
METALS & MINING	15	0.69	8.6	12.2	-3.6	40.0	1.27	11.7	2.36	2.2	3	7	4	8	2	-3.20	60	-3
PAPER & FOREST PROD	2	0.02				15.9	1.43	10.6	2.96	1.8	4	10	1	7	10	13.40	nm	nm
INDUSTRIALS	188	8.47	10.5	11.3	-0.8	33.5	1.09	18.3	3.95	1.7	6	4	5	4	5	15.80	12	16
AEROSPACE & DEF	25	1.71	9.7	10.7	-1	32.7	1.00	24.6	3.16	1.5	5	4	6	4	6	29.80	59	63
BLDGS PRODUCTS	11	0.45	10.3	11.6	-1.3	34.7	1.13	17.5	3.87	1.8	9	4	5	3	4	8.20	12	9
CONSTR. & ENGR	7	0.10	11.7	12.8	-1.1	32.6	1.25	19.0	3.08	0.7	6	4	7	5	4	16.20	12	22
ELECTRICAL EQUIP	19	0.57	10.9	12.1	-1.2	35.2	1.23	24.2	3.95	1.6	5	3	5	3	4	11.60	9	1
IND CONGLOMERATES	3	0.78	10.0	11.4	-1.4	38.5	1.09	21.4	4.69	2.1	6	5	5	3	7	8.50	nm	nm
MACHINERY	34	1.52	11.3	11.5	-0.2	32.2	1.11	14.3	3.92	1.8	6	4	6	4	3	12.00	19	21
TRADING COMPANIES	13	0.26	14.9	15.4	-0.5	24.1	1.39	9.3	2.07	1.5	3	5	5	5	4	7.80	4	-1
COMMERCIAL SVS	11	0.39	9.1	10.1	-1	41.2	0.95	28.8	6.42	1.2	4	2	5	3	5	9.70	9	14
PROFESSIONAL SVS	30	0.95	10.8	10.5	0.3	34.8	0.99	22.0	5.23	1.4	6	3	5	2	5	14.40	13	10
AIR FREIGHT & LOGIS	3	0.51	10.4	11.5	-1.1	31.3	1.09	15.3	4.75	3.2	7	8	2	5	6	4.40	-12	0
PASSENGER AIRLINES	12	0.21	19.3	12.6	6.7	15.2	1.23	6.6	2.17	0.7	6	9	10	7	4	60.10	nm	61
MARINE	2	0.02	9.2	12.2	-3	44.0	1.33	51.9	0.35	32.0	6		6	5	6	12.00	nm	nm
GROUND	18	1.02	10.5	11.6	-1.1	34.0	1.13	21.7	5.10	1.5	6	4	5	4	5	10.30	-30	41
CONSUMER DISCR	199	11.02	9.6	12.2	-2.6	41.6	1.20	22.6	4.76	0.9	4	5	6	5	6	14.10	33	13
AUTO COMP	14	0.28	11.1	14.8	-3.7	33.8	1.52	18.9	2.25	0.7	4	7	7	5	7	23.50	-63	314
AUTOMOBILES	7	1.47	9.6	15.7	-6.1	45.2	1.60	27.9	3.26	0.5	2	9	4	8	8	8.30	nm	nm
HOUSEHOLD DURABLES	15	0.38	11.4	12.4	-1	30.4	1.24	11.1	1.79	1.3	6	2	2	6	3	-4.00	17	-30
LEISURE PRODUCTS	8	0.07	9.9	12.5	-2.6	36.7	1.27	17.6	2.30	1.4	5	6	6	6	9	5.90	-16	116
TEXTILES, APPAREL	16	0.74	9.7	11.8	-2.1	41.6	1.14	23.5	7.19	1.0	6	5	4	4	3	10.60	-1	5
HOTELS, RESTAURANTS & LEISURE	54	2.67	11.5	11.4	0.1	31.0	1.11	27.0	7.41	1.1	5	6	7	4	4	28.20	nm	110
DIV CONSUMER SVS	13	0.10	9.5	9.6	-0.1	38.2	1.03	14.9	3.13	0.9	3	6	5	6	6	17.70	164	151
MEDIA	1	0.02	10.2	11.3	-1.1	36.7	1.07	7.2		0.0					8	0.50	nm	nm
DISTRIBUTORS	3	0.10	9.8	10.2	-0.4	35.3	0.95	20.1	6.81	1.8	8	7	4	3	5	5.00	nm	nm
MULTILINE RETAIL	14	2.82	7.7	12.3	-4.6	55.7	1.20	27.5	6.88	0.1	2	6	8	7	6	12.70	nm	nm
SPECIALTY RETAIL	54	2.37	9.9	10.9	-1	35.7	1.03	17.7	5.07	1.8	5	4	4	4	6	7.20	-15	-13
CONSUMER STAPLES	60	6.93	9.5	8.5	1	36.9	0.73	21.1	5.47	2.4	7	5	4	2	5	8.00	4	3
DISTRIBUTION & RETAIL	12	1.84	10.0	9.4	0.6	38.5	0.78	20.9	5.90	1.5	6	4	4	3	6	9.00	14	7
BEVERAGES	12	1.77	9.0	8.6	0.4	38.4	0.75	25.8	7.61	2.4	8	5	4	1	4	10.00	4	7
FOOD PRODUCTS	22	1.12	9.7	7.9	1.8	36.0	0.69	18.2	2.66	2.4	7	3	4	3	4	6.20	0	-4
TOBACCO	2	0.62	12.1	8.9	3.2	20.2	0.78	12.6		6.1	5	3	6	2	3	7.10	nm	nm
HOUSEHOLD PRODUCTS	5	1.37	8.8	7.4	1.4	39.8	0.61	25.5	9.26	2.4	6	6	4	1	5	6.30	0	4
PERSONAL PRODUCTS	7	0.21	7.9	11.5	-3.6	49.9	1.10	31.7	8.63	0.8	7	7	4	5	6	6.50	1	2

Source: BofA US Equity and Quant Strategy, FactSet

Exhibit 42: BofA Universe Sector/Industry Factor Evaluation (cont'd)

As of 4/30/2023

			Valuation Analysis								Expectation Analysis							
	# of Comp	% Univ BofA	Impl. Return	Reqd Return	DDM Alpha	Eqty. Duration	BofA Adj ßeta	P/E Ratio	Price/ Book	Yield	Surprise	Earnings (Decile) Risk	Torp	Disp	Est. Rev.	PR 5yr Growth	EPS Growth 2023E	2024E
HEALTH CARE	273	14.46	10.6	9.1	1.5	35.0	0.81	21.3	3.72	1.5	5	6	4	3	5	11.10	-13	-3
HEALTH CARE EQUIP	46	2.78	9.2	10.4	-1.2	42.8	0.92	28.8	4.60	1.0	5	6	4	2	4	8.60	-4	-3
HEALTH CARE PROV	51	3.10	11.1	9.5	1.6	32.7	0.87	15.5	3.00	1.3	4	3	6	2	4	13.40	10	6
HEALTH CARE TECH	11	0.13	8.7	10.7	-2	44.4	1.00	56.3	4.04	0.0	5	2	5	4	5	15.30	-46	2
BIOTECH	115	2.75	10.0	8.0	2	34.1	0.75	36.5	4.81	1.8	6	6	4	6	7	14.40	-55	-25
PHARMACEUTICALS	30	4.01	10.6	7.7	2.9	32.4	0.67	16.9	2.52	2.5	4	8	4	3	5	7.10	-15	-4
LIFE SCIENCES	20	1.68	13.0	10.8	2.2	34.4	0.96	25.0	4.39	0.3	5	4	4	3	6	15.50	18	9
FINANCIALS	169	10.61	11.4	11.1	0.3	30.7	1.06	12.6	1.87	2.4	7	4	6	4	5	12.00	60	9
BANKS	29	2.57	12.1	11.4	0.7	26.1	1.08	9.0	1.02	3.7	9	4	6	5	4	7.20	-27	35
FINANCIAL SERVICES	30	2.82	11.0	11.3	-0.3	35.1	1.08	18.8	5.47	0.8	5	3	6	2	4	14.90	24	16
CONSUMER FINANCE	11	0.50	12.5	12.2	0.3	28.0	1.22	10.3	1.64	2.0	7	6	5	5	4	9.60	nm	nm
CAPITAL MARKETS	50	2.60	11.7	11.8	-0.1	28.7	1.13	13.7	2.27	2.9	6	4	6	4	6	9.20	nm	-6
MORTGAGE REITS	15	0.09	12.0	14.4	-2.4	20.0	1.33	6.4	0.86	12.5	4	6	3	5	6	9.10	10	15
INSURANCE	34	2.03	10.5	9.6	0.9	32.3	0.87	13.4	2.11	1.9	7	5	7	3	5	18.60	nm	nm
INFO TECH	168	24.95	10.0	11.9	-1.9	39.2	1.14	25.2	8.26	0.9	5	4	4	4	5	14.80	8	0
INTERNET SOFTWARE	1	0.03	10.3	14.6	-4.3	38.1	1.48	37.4		0.0	5		4	8	9	12.90	nm	nm
IT SERVICES	17	1.23	10.2	12.1	-1.9	30.9	1.17	21.0	4.68	2.0	8	3	5	3	5	22.90	14	10
SOFTWARE	83	9.90	9.9	10.8	-0.9	40.1	1.01	29.1	9.24	0.6	4	4	5	3	4	17.60	11	11
COMMUNICA. EQUIP	9	0.69	11.1	10.9	0.2	31.7	1.02	13.0	4.42	2.5	5	9	7	3	3	10.10	5	10
TECH. H/W, STORAGE & PERIPH	9	6.83	9.6	12.3	-2.7	42.9	1.20	25.9	29.20	0.7	7	2	3	3	6	10.60	3	-3
ELECTR EQUIP & INSTR	16	0.61	10.0	11.9	-1.9	38.7	1.15	14.6	2.92	1.2	5	5	4	3	6	6.20	17	3
SEMICONDUCTORS	33	5.65	10.7	13.3	-2.6	35.4	1.31	24.3	5.28	1.2	6	5	5	6	5	14.70	13	-14
COMMUNICATION SERVICES	53	9.67	13.0	11.2	1.8	27.7	1.05	13.9	3.52	0.7	2	4	7	6	4	18.30	17	18
DIVERSIFIED TELECOM SVS	5	0.79	12.5	8.5	4	21.4	0.66	8.0	1.34	6.3	8	6	2	3	7	0.80	-87	nm
WIRELESS TELECOM SVS	1	0.22		8.2		16.4	0.70	17.8	2.59	0.0	2	3	9	6	3	70.50	nm	nm
MEDIA	14	0.77	11.4	10.8	0.6	29.2	1.02	11.0	1.73	2.3	5	6	6	5	5	7.10	8	5
ENTERTAINMENT	18	1.36	13.2	12.0	1.2	28.6	1.19	23.6	2.69	0.1	4	5	6	6	5	26.80	23	18
INTERACTIVE MEDIA & SVCS	15	6.53	13.2	11.4	1.8	28.1	1.08	14.3	5.09	0.0	1	3	7	6	3	18.30	nm	69
UTILITIES	59	2.98	9.8	8.3	1.5	32.2	0.71	18.3	2.05	3.3	6	4	5	2	5	7.20	39	13
ELECTRIC UTILITIES	25	1.82	10.0	8.2	1.8	31.5	0.69	18.2	2.03	3.2	6	4	5	1	5	6.10	-38	52
GAS UTILITIES	8	0.12	10.3	8.9	1.4	31.5	0.78	15.8	1.63	3.4	9	4	4	2	5	6.90	6	2
MULTI-UTILITIES	15	0.81	9.4	8.1	1.3	33.9	0.70	18.4	2.04	3.5	5	5	4	2	5	5.80	7	-4
WATER UTILITIES	2	0.10	8.9	8.6	0.3	39.1	0.75	28.4	2.69	2.1	7	3	4	1	5	7.80	6	6
INDEP POWER PROD & ENERGY TRAD	9	0.13	11.4	9.9	1.5	25.3	0.94	15.9	2.83	3.2	4	7	6	6	7	32.80	263	-1
REAL ESTATE	94	2.84	10.1	10.1	0	31.1	0.92	17.5	2.24	3.9	6	5	4	2	7	6.40	49	9
DIVERSIFIED REITS	5	0.06	9.9	10.3	-0.4	27.6	0.95	13.0	1.47	5.5	5	4	3	2	6	1.60	nm	nm
INDUSTRIAL REITS	7	0.39	9.2	10.5	-1.3	35.2	0.98	22.0	1.85	2.9	5	5	4	2	6	6.20	nm	nm
HOTEL & RESORT REITS	10	0.08	12.3	14.0	-1.7	20.3	1.33	8.8	1.26	2.9	5	9	6	4	8	12.00	197	1
OFFICE REITS	14	0.13	12.1	10.2	1.9	19.4	1.01	8.2	0.83	6.2	5	7	4	1	7	-6.50	nm	nm
HEALTH CARE REITS	8	0.22	9.9	11.2	-1.3	32.7	1.03	14.4	1.52	5.0	8	8	4	2	8	4.00	nm	nm
RESIDENTIAL REITS	10	0.38	10.1	9.6	0.5	31.2	0.87	17.7	2.41	3.4	6	4	4	1	7	6.90	nm	nm
RETAIL REITS	19	0.39	10.6	11.4	-0.8	26.1	1.09	12.0	1.88	5.2	6	5	4	1	6	3.00	nm	nm
SPECIALIZED REITS	17	1.15	10.1	8.8	1.3	32.5	0.79	24.8	4.13	3.6	8	4	4	3	7	9.80	nm	nm
REAL ESTATE MGMT & DEV	4	0.04	10.3	14.2	-3.9	38.3	1.42	nm	2.03	0.9	5	8	5	9	9	7.90	-99	nm
BofA UNIVERSE	**1401**	**100.00**	**10.7**	**11.0**	**-0.3**	**34.7**	**1.04**	**22.5**	**3.69**	**1.6**						**13.70**	**16**	**2**
S&P 500	**503**	**92.01**	**10.6**	**10.9**	**-0.3**	**35.1**	**1.02**	**22.8**	**3.77**	**1.6**						**12.20**	**13**	**1**

Source: BofA US Equity and Quant Strategy, FactSet

Performance Calculation Methodology

For each of the strategies represented in this report, rebalancing and performance calculations are conducted each month, using data and closing prices corresponding to the market's close on the last business day of each month. The performance of each index is computed on the basis of price return. The performance is presented relative to the benchmark which consists of the equal weighted price performance of stocks in the S&P 500 as of the last business day of each month. For Alpha Surprise model, the performance is also represented as relative to the market capitalization-weighted S&P 500 benchmark.

The results of quantitative strategies presented here may differ from the S&P 500 in that they are significantly less diversified, and, as such, their performance is more exposed to specific stock or sector results. Therefore investors following these strategies may experience greater volatility in their returns.

The analysis in this report is back-tested and does not represent the actual performance of any account or fund. Back-tested performance depicts the hypothetical back-tested performance of a particular strategy over the time period indicated. In future periods, market and economic conditions will differ and the same strategy will not necessarily produce the same results. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. In fact, there are frequently sharp differences between back-tested returns and the actual results realized in the actual management of a portfolio. Back-tested performance results are created by applying an investment strategy or methodology to historical data and attempts to give an indication as to how a strategy might have performed during a certain period in the past if the product had been in existence during such time. Back-tested results have inherent limitations including the fact that they are calculated with the full benefit of hindsight, which allows the security selection methodology to be adjusted to maximize the returns. Further, the results shown do not reflect actual trading or the impact that material economic and market factors might have had on a portfolio manager's decision-making under actual circumstances. Back-tested returns do not reflect advisory fees, trading costs, or other fees or expenses.

The performance results do not reflect transaction costs, tax withholdings or any investment advisory fees. Had these costs been reflected, the performance would have been lower. The performance results of individuals following the strategies presented here will differ from the performance contained in this report for a variety of reasons, including differences related to incurring transaction costs and/or investment advisory fees, as well as differences in the time and price that securities were acquired and disposed of, and differences in the weighting of such securities. The performance results of individuals following these strategies will also differ based on differences in treatment of dividends received, including the amount received and whether and when such dividends were reinvested.

Dividend Yield and Dividend Growth Strategies

We also provide total returns for dividend oriented strategies (high dividend yield strategy and high dividend growth strategy). The total return performance calculation assumes that dividends paid on securities in a portfolio are deposited in a cash account on the ex-dividend date, and are not reinvested. The performance is presented relative to the equal weighted total returns index of stocks in the S&P 500 as of the last business day of each month.

This report includes strategies for informational or descriptive purposes, and inclusion here is not equivalent to a recommendation of the strategy or portfolio.

Past performance should not and cannot be viewed as an indicator of future performance. A complete performance record is available upon request.

Advances & Declines

Advances and declines are based on the price returns of each stock for each relevant period. The portfolio rebalancing done each month constitutes the start of a new period for each stock in the portfolio. The performance period for the stock being removed will end when the stock is removed from the portfolio. For the stock being added, the performance period will begin when it is added to the portfolio.

Definitions

Absolute return: Absolute return is calculated based on monthly returns and reflects simple price appreciation (depreciation) over the stated period. Stocks in each screen are equally weighted. Returns do not reflect dividend or transaction costs.

P/E-to-Growth: Trailing twelve months P/E divided by the five-year EPS growth rate estimated by BofA Fundamental Equity Research. If no BofA estimate exists, then the IBES Mean Long Term Growth Estimate is used.

Dividend Discount Model Alpha: The implied return from the BofA Quantitative Strategy three-stage dividend discount model less the required return from a Capital Asset Pricing Model. Presented as a decile rank.

Earnings Yield: Trailing 12-month EPS divided by month-end price

Forward Earnings Yield: Rolling 12-month forward EPS divided by month-end price

Price/Book Value: Month-end price divided by the most recently reported book value per share.

Price/Cash Flow: Month-end price divided by the most recently reported cash flow. Cash flow is defined as earnings post extraordinary items plus depreciation.

Price/Free Cash Flow: Month-end price divided by most recently reported free cash flow. Starting November 2022, we updated Free Cash Flow (FCF) calculation methodology from (Net Income + Depreciation & Amortization – CapEx) to use (Operating Cash Flow - CapEx) instead.

Price/Sales: Month-end market value divided by most recently reported sales.

EV/EBITDA: Enterprise Value (Equity Market Capitalization + Long Term Debt + Short Term Debt + Preferred Stock + Minority Interest – Cash & Cash Equivalents) divided by EBITDA (Reported Net Income + Special Items – Minority Interest + Interest Expense + Income Tax Expense + Depreciation and Amortization) – most recently reported.

Free Cash Flow/EV: Free Cash Flow divided by Enterprise Value (Equity Market Capitalization + Long Term Debt + Short Term Debt + Preferred Stock + Minority Interest – Cash & Cash Equivalents). Starting November 2022, we updated Free Cash Flow (FCF) calculation methodology from (Net Income + Depreciation & Amortization – CapEx) to use (Operating Cash Flow - CapEx) instead. For our FCF/EV factor, in addition to the methodology change to our FCF calculation (which represents Free Cash Flow to Equity), we also changed to use FCF to the Firm (FCFF) by adding back interest expense: (Operating Cash Flow – CapEx + Interest Expense*(1-tax rate)).

Dividend Yield: Indicated dividend divided by month-end price.

Dividend Growth: The growth between trailing 4-quarter total common dividends and year-ago trailing 4-quarter total common dividends.

Share Repurchase: The year-to-year change in shares outstanding

Rel Str – 30Wk/75Wk MA: The ratio of the 30-week moving average of price to the 75-week moving average.

Rel Str – 5Wk/30Wk MA: The ratio of the 5-week moving average of price to the 30-week moving average.

Rel Str – 10Wk/40Wk MA: The ratio of the 10-week moving average of price to the 40-week moving average.

Price/200-Day Moving Average: A ratio between month-end closing price and average closing price over the last 200 days.

Price Return – 12-Month Performance: Absolute price return over the last twelve months.

Price Return – 9-Month Performance: Absolute price return over the last nine months.

Price Return – 3-Month Performance: Absolute price return over the last three months.

Price Return – 11-Month Performance: Absolute price return from one year ago, ignoring the most recent month.

Price Return – 12-Month and 1-Month Performance: Equal weighted rank of stocks by (1) highest price return over the last twelve months and (2) highest price return over the most recently ended month.

Price Return – 12-Month and 1-Month Reversal: Equal weighted rank of stocks by (1) highest price return over the last twelve months and (2) lowest price return over the last one month.

Most Active: Stocks have the highest monthly share trading volume.

Earnings Momentum: The difference between 12-month trailing EPS and year-ago 12-month trailing EPS divided by year-ago 12-month trailing EPS.

Projected 5-Year EPS Growth: The five-year EPS growth rate estimated by BofA Fundamental Equity Research. If no BofA estimate exist, then I/B/E/S Mean Long Term Growth Estimate is used.

Forecast Earnings Surprise: A forecast earnings surprise variable which compares BofA estimates to those of the consensus after adjusting for the range of estimates. Stocks are ranked from 1 to 10, with 1 being among the most optimistic, relative to the consensus, 10 being among the most pessimistic. Consensus estimated earnings data are courtesy of I/B/E/S. If the projected Surprise is greater than 13 standard deviations, the stock is excluded as an outlier.

Positive (Negative) Forecast Earnings Surprise: The companies ranked 1 or 2 (9 or 10) by Forecast Earnings Surprise.

EPS Estimate Revision: The difference between the I/B/E/S FY1 estimate and that of three months ago divided by the absolute value of I/B/E/S FY1 estimate of three months ago.

Equity Duration: An adaptation of our Dividend Discount Model which measures the interest-rate sensitivity of a stock. Longer durations (higher numbers) suggest more interest-rate sensitivity.

Earnings Torpedo: I/B/E/S FY2 estimate less latest actual annual EPS divided by month-end price.

Return on Equity One-Year Average: Net income divided by average equity provided.

Return on Equity Five-Year Average: Five-year average return on equity.

Return on Equity One-Year Average (Adjusted for Debt): The ROE of companies with higher debt levels are considered lower than those of companies with lower debt levels based on their debt-to-equity ratios.

Return on Equity Five-Year Average (Adjusted for Debt): The average five year ROE of companies with higher debt levels are considered lower than those of companies with lower debt levels based on their debt-to-equity ratios.

Return on Assets: Net income plus interest and taxes as a percent of average total assets.

Return on Capital: The sum of net income, interest expense and minority interest, as a percent of average total invested capital which is inclusive of long-term debt, preferred stock, common equity, and minority interest.

Beta: A measure of non-diversifiable risk. It is calculated using regression Strategy incorporating 60 months of price performance versus that of the S&P 500.

Variability of EPS: The degree of variability in quarterly EPS over the past 5 years. Stocks are ranked from 10 to 1 with 10 being the most variable.

EPS Estimate Dispersion: The coefficient of variation among I/B/E/S FY2 estimates. Presented as a decile rank.

Price: Absolute price level of the stock at month-end.

Neglect-Institutional Ownership: Those companies with the lowest proportions of float-adjusted shares held by institutional owners are considered more neglected.

Neglect-Analyst Coverage: Those companies with the lowest number of analysts submitting ratings to FirstCall.

Firm Size: Month-end market value.

Foreign Exposure: The ratio of foreign sales to total sales.

Short Interest 12-mth Z-Score: (Most recent number of short shares – 12mth average of short shares)/ 12mth standard deviation of short shares.

Inputs for the US Regime Indicator

Inputs for the US regime indicator include the following eight macroeconomic or top-down variables listed below. In this report we also extended the indicator history going back to 1970, with available inputs listed on the bottom of the page.

- **Earnings Revision ratio:** Calculated as the ratio between the number of companies in the S&P 500 for which Thomson Financial consensus earnings estimates have been raised versus those that have been lowered. A rising ratio indicates an improving economic cycle.
- **ISM PMI:** ISM PMI Institute for Supply Management Manufacturing Purchasing Managers Index, represented as the Z-Score. The ISM Manufacturing Index monitors economic activity as reported by 300 supply management professionals. The reading of the index above (below) 50 indicated economic expansion (contraction).
- **Inflation:** The 12-month change in the BofA Inflation Composite (see methodology further below), represented as the Z-Score. Rising inflation indicates improving economic conditions.
- **GDP Forecast:** The next 12-month US GDP growth forecast from the Federal Reserve Bank of Philadelphia Survey, represented as the Z-Score.
- **Leading Economic Indicators index:** The 12-month change in the Conference Board US Leading Index of Ten Economic Indicators, represented as a Z-Score. A rising Z-Score indicates improving economic conditions.
- **US Capacity Utilization:** The 12-month change in US capacity utilization, represented as the Z-score. The capacity utilization rate indicates the percentage of total economic capacity currently utilized. Rising capacity utilization implies improving economic conditions. Rising capacity utilization suggests more expanding economic cycle and potentially rising inflationary pressure.
- **10-yr US Treasury Bond Yield:** The 12-month change in the bond yield, represented as the Z-Score. Rising yields indicate improving economic conditions.
- **High Yield corporate bond credit spread:** The 12-month change in the US High Yield credit spread of the ICE BofA US High Yield Index, represented as a Z-score. Falling spreads indicate improving economic conditions.

For the historic period from January 1970 to December 1989, the US Regime Indicator was based on the available inputs listed above, which were:

- 1/70 to 1/82: 5 inputs: Inflation, 10-yr US Treasury Bond Yield, ISM PMI, Leading Economic Indicators index, US Capacity Utilization;
- 2/82 to 3/88: 6 inputs: all of the above plus GDP Forecast;
- 4/88 to 4/89: 7 inputs: all of the above plus the High Yield corporate bond credit spread;
- 5/89 to 12/89: all 8 inputs: all of the above plus the Earnings Revision Ratio.

Performance of sizes/styles during regimes prior to January 1990 could be impacted by the more limited set of factors used to determine regimes, different definitions for Growth, Value and Size (where we use Fama-French performance data for the 1970-1989 period vs. performance of our S&P 500 top/bottom decile factors over the original history of our indicator from 1990-present), as well as the different macro backdrop in the earlier period marked by high inflation.

Disclosures

Important Disclosures

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Investment rating	Total return expectation (within 12-month period of date of initial rating)	Ratings dispersion guidelines for coverage cluster[R1]
Buy	≥ 10%	≤ 70%
Neutral	≥ 0%	≤ 30%
Underperform	N/A	≥ 20%

[R1] Ratings dispersions may vary from time to time where BofA Global Research believes it better reflects the investment prospects of stocks in a Coverage Cluster.

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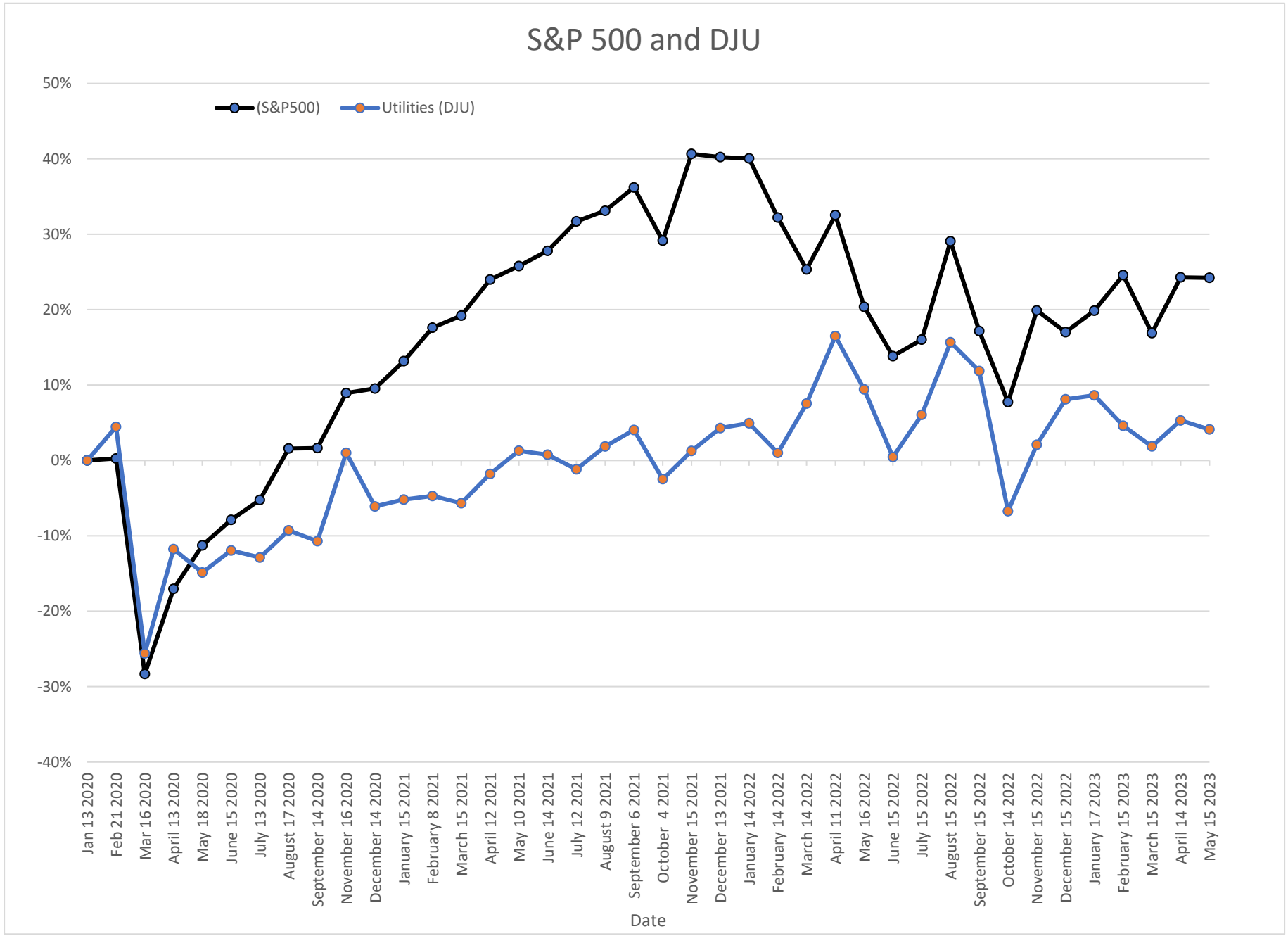
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The pure-play methodology assumes that the pure-play companies have the same business risk as the division, and that, indeed, such pure-play companies can be identified to begin with. One difficulty with the approach is to identify undiversified ''single line of business'' proxy companies. The pool of pure-play companies is shrinking as utilities become more diversified over time. In fact, most companies, including utilities, are not perfectly homogeneous in risk and have multiple lines of business. Moreover, to the extent that the universe of pure-play companies is dwindling, the influence of abnormal observations, or outliers, on the proxy cost of capital estimate increases. Finally, the choice of screening parameters and cutoff points in defining a sample of pure-plays is arbitrary and judgmental. The analyst possesses a fair amount of latitude in defining screening criteria, such as degree of diversification, bond rating, company size, and non-utility business.

Another difficulty is that although the task of applying the pure-play approach to the broader utility segment of a diversified company is practically feasible, the task of applying the method at the more micro level, to each service category or customer class for example, becomes operationally prohibitive. A sample of market-traded firms comparable in risk to each of the individual service categories can be difficult to locate.

Another limitation of the technique is that it ignores the benefits of corporate diversification, that is to say, it assumes that the risk of a total company is simply the sum of the risk of its parts.

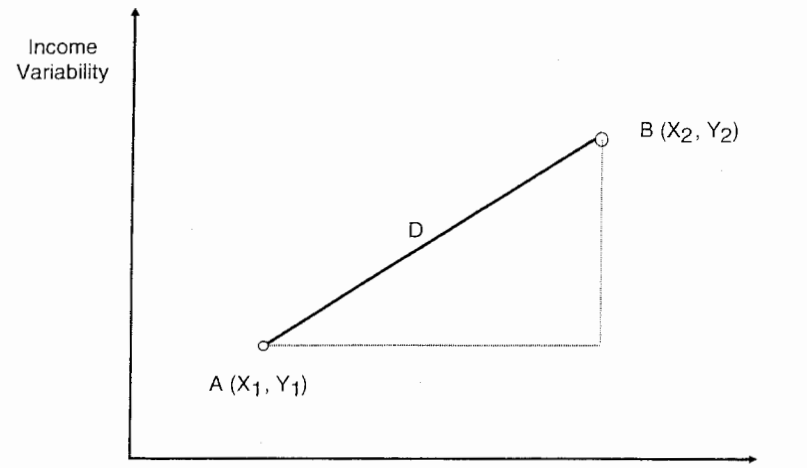
Cluster Analysis

With the Cluster Analysis approach, comparable companies are selected on the basis of ''closeness'' to the targeted entity in terms of such predetermined risk variables as bond rating, after-tax interest coverage, equity ratio, total capital, and variability of operating income. Cluster analysis generates a small group of publicly traded firms that are comparable in risk to a target division or firm from a much larger universe of diverse companies.

After determining the location of each publicly traded firm on a graph whose coordinates are the selected risk measures, closeness can be measured by the length of a straight line between the point associated with the division in question and the points associated with each other firm. This measurement process is illustrated graphically in Figure 7-3 for two risk measures: bond rating and income variability. Firm A has a lower income variability and a higher bond rating than firm B, as shown by points A and B on the graph.

The risk comparability of firms A and B is measured mathematically by the distance on the graph, or closeness, between the two points A and B as follows: If X and Y are two axes on a graph corresponding to two risk

FIGURE 7-3
CLUSTER ANALYSIS
Distance Concept



measures, and there are two points on a graph with coordinates (X_1,Y_1) and (X_2,Y_2), then the distance, D, between the two points is given by:

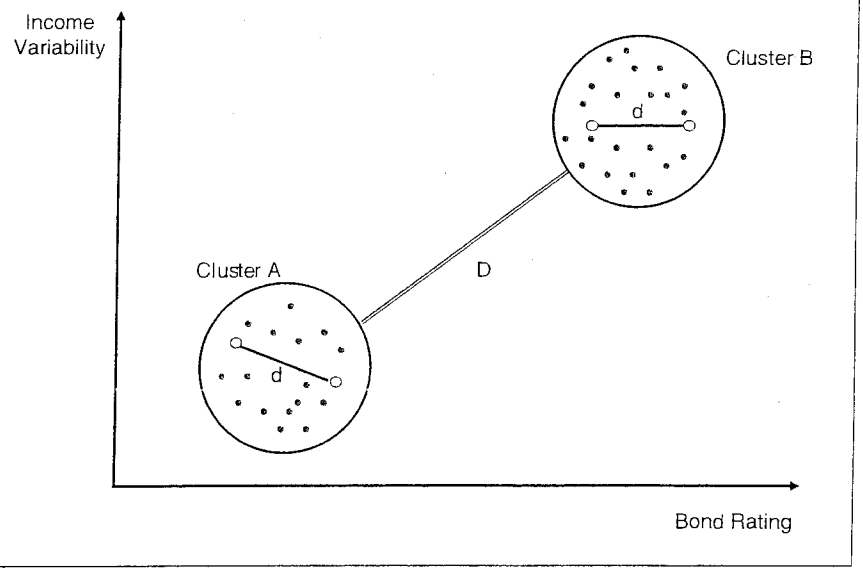
$$D = (X_2 - X_1)^2 + (Y_2 - Y_1)^2 \qquad (7\text{-}2)$$

If the X and Y axes corresponding to the two risk variables are not measured in the same units, it is necessary to convert them to a common measure using the standard deviation of the sample as scale factors.

This process can be easily extended to include as many risk variables as desired. Figure 7-4 displays the cluster analysis in simplified form using two risk variables. Two clusters of companies are shown on the graph in the form of two small circles, one cluster similar in risk to firm A and the other cluster similar in risk to firm B. Firms A and B could just as well be divisions rather than publicly traded firms. Operationally, the clustering criteria must be loose enough so as to include a sufficient number of companies, but also stringent enough so as to provide a comparable group of companies close to the candidate firm. This tradeoff can be seen by comparing the distance, D, between the two clusters and the diameter, d, of the two circles in Figure 7-4.

The distance between clusters has to be significantly larger than the distance within clusters if risk comparability is to be achieved, but d has to be large enough to allow the entry of a sufficient number of companies. A cluster size of 15 to 30 firms is reasonable. Once a cluster of comparable companies is identified for each firm or division, the average DCF and CAPM/ECAPM

FIGURE 7-4
CLUSTER ANALYSIS
Graphical Representation



cost of equity estimates for the publicly traded companies are used as estimates of equity costs for the divisions.

An excellent example of cluster analysis is provided by Vander Weide (1993) who implements the approach in 5 distinct steps. First, an adequate universe of companies is defined with sufficient market data to enable a DCF calculation and sufficient accounting data to compute the risk variables. Second, relevant risk variables that define the overall investment risk of the companies are selected. Vander Weide used the following 5 dimensions of investment risk and their associated measurement:

Risk Dimension	Risk Measurement
Variability	Operating income variability
Growth	Sales growth
Operating risk	Cash flow/assets ratio
Financial risk	Bond rating
Size	Total assets

Third, the risk variables are standardized for each firm because the risk variables are not measured in the same units. It is thus necessary to convert them to a common measure using the standard deviation of the sample as scale factors. Fourth, redundancies are eliminated by checking for the degree of correlation between each pair of risk variables. Highly correlated risk

Earnings Growth: The Two Percent Dilution

William J. Bernstein and Robert D. Arnott

Two important concepts played a key role in the bull market of the 1990s. Both represent fundamental flaws in logic. Both are demonstrably untrue. First, many investors believed that earnings could grow faster than the macroeconomy. In fact, earnings must grow slower than GDP because the growth of existing enterprises contributes only part of GDP growth; the role of entrepreneurial capitalism, the creation of new enterprises, is a key driver of GDP growth, and it does not contribute to the growth in earnings and dividends of existing enterprises. During the 20th century, growth in stock prices and dividends was 2 percent less than underlying macroeconomic growth. Second, many investors believed that stock buybacks would permit earnings to grow faster than GDP. The important metric is not the volume of buybacks, however, but net buybacks—stock buybacks less new share issuance, whether in existing enterprises or through IPOs. We demonstrate, using two methodologies, that during the 20th century, new share issuance in many nations almost always exceeded stock buybacks by an average of 2 percent or more a year.

The bull market of the 1990s was largely built on a foundation of two immense misconceptions. Whether their originators were knaves or fools is immaterial; the errors themselves were, and still are, important. Investors were told the following:

1. With a technology revolution and a "new paradigm" of low payout ratios and internal reinvestment, earnings will grow faster than ever before. Real growth of 5 percent will be easy to achieve.

Like the myth of Santa Claus, this story is highly agreeable but is supported by neither observable current evidence nor history.

2. When earnings are not distributed as dividends and not reinvested into stellar growth opportunities, they are distributed back to shareholders in the form of stock buybacks, which are a vastly preferable way of distributing company resources to the shareholders from a tax perspective.

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Note: This article was accepted for publication prior to Mr. Arnott's appointment as editor of the Financial Analysts Journal.

True, except that over the long term, net buybacks (that is, buybacks minus new issuance and options) have been reliably negative.

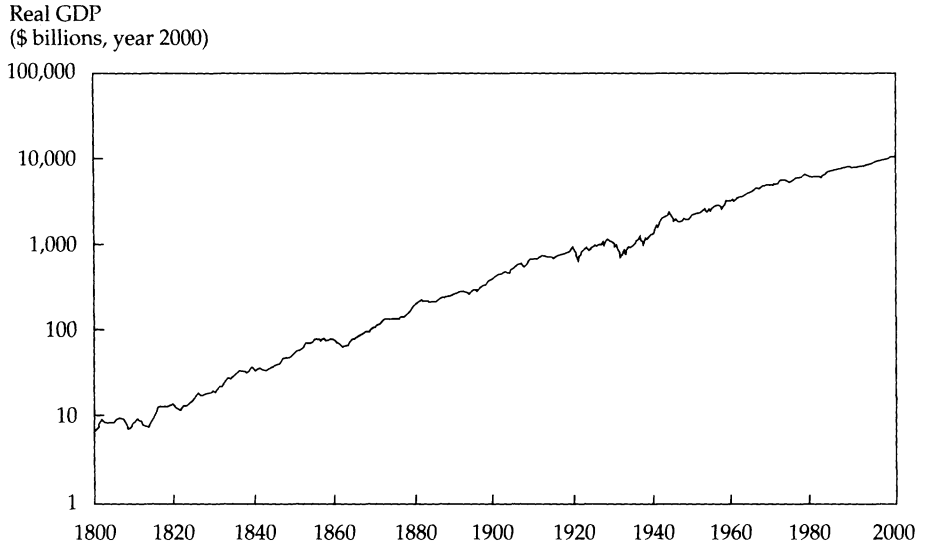
The vast majority of the institutional investing community has believed these untruths and has acted accordingly. Whether these tales are lies or merely errors, our implied indictment of these misconceptions is a serious one—demanding data. This article examines some of the data.

Big Lie #1: Rapid Earnings Growth

In the past two centuries, common stocks have provided a sizable risk premium to U.S. investors: For the 200 years from 1802 through 2001 (inclusive), the returns for stocks, bonds, and bills were, respectively, 8.42 percent, 4.88 percent, and 4.21 percent. In the most simplistic terms, the reason is obvious: A bill or a bond is a promise to pay interest and principal, and as such, its upside is sharply limited. Shares of common stock, however, are a claim on the future dividend stream of the nation's businesses. While the investor in fixed-income securities is receiving a modest fixed trickle from low-risk securities, the shareholder is the beneficiary of the ever-increasing fruits of innovation-driven economic growth.

Viewed over the decades, the powerful U.S. economic engine has produced remarkably steady growth. **Figure 1** plots the real GDP of the United States since 1800 as reported by the U.S. Department

Figure 1. Real U.S. GDP Growth, 1800–2000



of Commerce. From that year to 2000, the economy as measured by real GDP, averaging about 3.7 percent growth a year, has grown a thousandfold. The long-term uniformity of economic growth demonstrated in Figure 1 is both a blessing and a curse. To know that real U.S. GDP doubles every 20 years is reassuring. But it is also a dire warning to those predicting a rapid acceleration of economic growth from the computer and Internet revolutions. Such extrapolations of technology-driven increased growth are painfully oblivious to the broad sweep of scientific and financial history, in which innovation and change are constant and are neither new to the current generation nor unique.

The impact of recent advances in computer science pales in comparison with the technological explosion that occurred between 1820 and 1855. This earlier era saw the deepest and most far reaching technology-driven changes in everyday existence ever seen in human history. The changes profoundly affected the lives of those from the top to the bottom of the social fabric in ways that can scarcely be imagined today. At a stroke, the speed of transportation increased tenfold. Before 1820, people, goods, and information could not move faster than the speed of the horse. Within a generation, journeys that had previously taken weeks and months involved an order of magnitude less time, expense, danger, and discomfort. Moreover, important information that previously required the same long journeys could now be transmitted instantaneously.

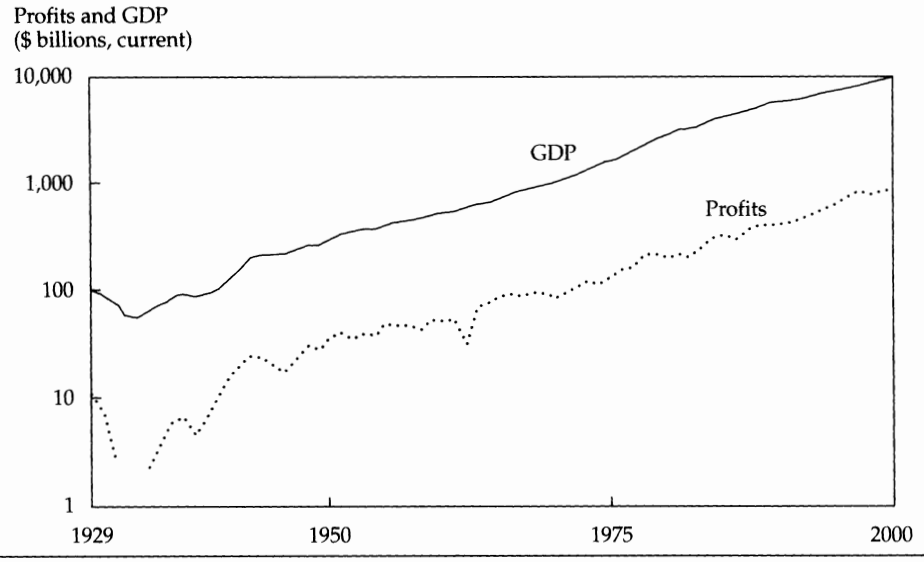
The average inhabitant of 1820 would have found the world 35 years later incomprehensible, whereas a person transported from 1967 to 2002 would have little trouble understanding the intervening changes in everyday life. From 1820 to 1855, the U.S. economy grew sixfold, four times the growth seen in the "tech revolution" of the past 35 years. More importantly, a close look at the right edge of Figure 1—the last decade of the 20th century—shows that the acceleration in growth during the "new paradigm" of the tech revolution of the 1990s was negligible when measured against the broad sweep of history.

The relatively uniform increase in GDP shown in Figure 1 suggests that corporate profits experienced a similar uniformity in growth. And, indeed, **Figure 2** demonstrates that, except for the Great Depression, during which overall corporate profits briefly disappeared, nominal aggregate corporate earnings growth has tracked nominal GDP growth, with corporate earnings remaining constant at 8–10 percent of GDP since 1929. The trend growth in corporate profits shown in Figure 2 is nearly identical, within a remarkable 20 bps, to the trend growth in GDP.[1]

Cannot stock prices also, then, be assumed to grow at the same rate as GDP? After all, a direct relationship between aggregate corporate profits and GDP has existed since at least 1929. The problem with this assumption is that per share earnings and dividends keep up with GDP *only if* no new shares are created. Entrepreneurial capitalism, however, creates a "dilution effect" through new enterprises and new stock in existing enterprises. So, per share earnings and dividends grow considerably slower than the economy.

In fact, since 1871, real stock prices have grown at 2.48 percent a year—versus 3.45 percent a year for GDP. Despite rising price–earnings ratios, we observe a "slippage" of 97 bps a year between stock

Figure 2. Nominal U.S. Corporate Profits and GDP, 1929–2000



prices and GDP. The true degree of slippage is much higher because almost half of the 2.48 percent rise in real stock prices after 1871 came from a substantial upward revaluation. The highly illiquid industrial stocks of the post–Civil War period rarely sold at more than 10 times earnings; often, they sold for multiples as low as 3 or 4 times earnings. These closely held industrial stocks gave way to instantly and cheaply tradable common shares, which today are priced nearly an order of magnitude more dearly.

Until the bull market of 1982–1999, the average stock was valued at 12–16 times earnings and 20–25 years' worth of dividends. By the peak of the bull market, both figures had tripled. Although the bull market was compressed into 18 years of the total period under discussion, this tripling of valuation levels was worth almost 100 bps a year—even when amortized over the full 130-year span. Thus, per share earnings and dividends grew 2 percent a year slower than the macroeconomy. If aggregate earnings and dividends grew as quickly as the economy while per share earnings and dividends were growing at an average of 2 percent a year slower, then shareholders have seen a slippage or dilution of 2 percent a year in the per share growth of earnings and dividends.

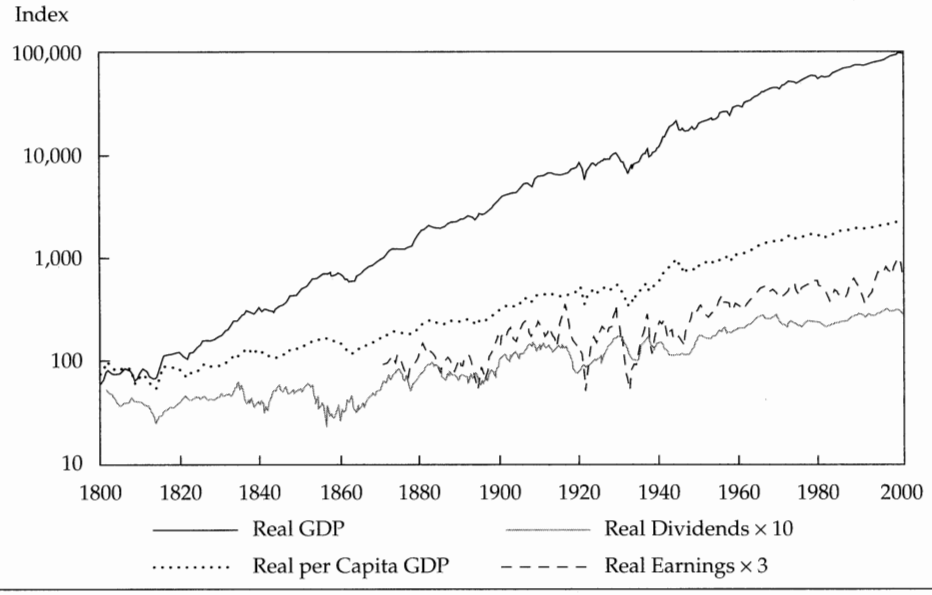
The dilution is the result of the net creation of shares as existing and new companies capitalize their businesses with equity. An often overlooked, but unsurprising, fact is that more than half of aggregate economic growth comes from new ideas and the creation of new enterprises, not from the growth of established enterprises. Stock investments can participate only in the growth of established businesses; venture capital participates only in the new businesses. The same investment capital cannot be simultaneously invested in both.

"Intrapreneurial capitalism," or the creation of new enterprises within existing companies, is a sound engine for economic growth, but it does not supplant the creation of new enterprises. Nor does it reduce the 2 percent gap between economic growth and earnings and dividend growth.

Note also that earnings and dividends grow at a pace very similar to that of per capita GDP (with some slippage associated with the "entrepreneurial" stock rewards to management). Consider that per capita GDP is a measure of productivity (with slight differences for changes in the work force) and aggregate economic wealth per capita can grow only in close alignment with productivity growth. Productivity growth is also the key driver of per capita income and of per share earnings and dividends. Accordingly, no one should be surprised that *per capita GDP, per capita income, per share earnings, and per share dividends—all grow in reasonably close proportion to productivity growth.*

If earnings and dividends grow faster than productivity, the result is a migration from return on labor to return on capital; if earnings and dividends grow more slowly, by a margin larger than the stock awards to management, then the economy migrates from rewarding capital to rewarding labor. Either way, such a change in the orientation of the economy cannot continue indefinitely. **Figure 3** demonstrates the close link between the growth of real corporate earnings and dividends and the growth of real per capita GDP; note that all of these measures exhibit growth far below the growth of real GDP.

Figure 3. Link of U.S. Earnings and Dividends to Economic Growth, 1802–2001



Note: Real GDP, real per capita GDP, and real stock prices were all constructed so that the series are on a common basis of January 1802 = 100.

A Global Laboratory

Is the United States unique? For an answer, we compared dividend growth, price growth, and total return with data on GDP growth and per capita GDP growth for the 16 countries covered by Dimson, Marsh, and Staunton (2002) spanning the 20th century.[2] The GDP data came from Maddison's (1995, 2001) world GDP survey for 1900–1998 and International Finance Corporation data for 1998–2000. The interrelationships of the data shown in **Table 1** are complex:

- The first column contains the real return (in U.S. dollars) of each national stock market.
- The second is real per share dividend growth.
- The third is real aggregate GDP growth for each nation (measured in U.S. dollars).
- The fifth is growth of real per capita GDP (measured in U.S. dollars).
- Thus, the fourth column measures the gap between growth in per share dividends and aggregate GDP—an excellent measure of the leakage that occurs between macroeconomic growth and the growth of stock prices.
- The last column represents the gap between the growth in per share dividends and per capita GDP.

For the full 16-nation sample in Table 1, the average gap between dividend growth and the growth in aggregate GDP is a startling 3.3 percent. The annual shortfall between dividend growth and per capita GDP growth is still 2.4 percent.

The 20th century was not without turmoil. Therefore, we divided the 16 nations into two groups according to the degree of devastation visited upon them by the era's calamities. The first group suffered substantial destruction of the countries' productive physical capital at least once during the century; the second group did not.

The nine nations in Group 1—Belgium, Denmark, France, Germany, Italy, Japan, the Netherlands, Spain, and the United Kingdom—were devastated by one or both of the two world wars or by civil war. The remaining seven—Australia, Canada, Ireland, South Africa, Sweden, Switzerland, and the United States—suffered relatively little direct damage. Even in this fortunate group, Table 1 shows dividend growth that is 2.3 percent less than GDP growth and 1.1 percent less than per capita GDP growth, on average. These gaps are close to the 2.7 percent and 1.4 percent figures observed in the United States during the 20th century.

The data for nations that were devastated during World Wars I and II and the Spanish Civil War are even more striking: The good news is that the economies in Group 1 repaired the devastations wrought by the 20th century; they enjoyed overall GDP growth and per capita GDP growth that rivaled the growth of the less-scarred Group 2 nations. The bad news is that the same cannot be said for per share equity performance; a 4.1 percent slippage occurred between the growth of their economies and per share corporate payouts. The

Table 1. Dilution of GDP Growth as It Flows Through to Dividend Growth: 16 Countries, 1900–2000

Country	Constituents of Real Stock Returns		Real GDP Growth	Dilution in Dividend Growth (vis-à-vis GDP growth)	Real per Capita GDP Growth	Dilution in Dividend Growth (vis-à-vis per capita GDP growth)
	Real Return	Dividend Growth				
Australia	7.5%	0.9%	3.3%	–2.4%	1.6%	–0.7%
Belgium	2.5	–1.7	2.2	–3.9	1.8	–3.5
Canada	6.4	0.3	4.0	–3.7	2.2	–1.9
Denmark	4.6	–1.9	2.7	–4.6	2.0	–3.9
France	3.6	–1.1	2.2	–3.3	1.8	–2.9
Germany	3.6	–1.3	2.6	–3.9	1.6	–2.9
Ireland	4.8	–0.8	2.3	–3.1	2.1	–2.9
Italy	2.7	–2.2	2.8	–5.0	2.2	–4.4
Japan	4.2	–3.3	4.2	–7.5	3.1	–6.4
Netherlands	5.8	–0.5	2.8	–3.3	1.7	–2.2
South Africa	6.8	1.5	3.4	–1.9	1.2	0.3
Spain	3.6	–0.8	2.7	–3.5	1.9	–2.7
Sweden	7.6	2.3	2.5	–0.2	2.0	0.3
Switzerland	5.0	0.1	2.5	–2.4	1.7	–1.6
United Kingdom	5.8	0.4	1.9	–1.5	1.4	–1.0
United States	6.7	0.6	3.3	–2.7	2.0	–1.4
Full-sample average	5.1	–0.5	2.8	–3.3	1.9	–2.4
War-torn Group 1 average	4.0	–1.4	2.7	–4.1	1.9	–3.3
Non-war-torn Group 2 average	6.4	0.7	3.0	–2.3	1.8	–1.1

creation of new enterprises in the wake of war was an even more important engine for economic recovery than in the Group 2 nations.

Thus, in Group 2 "normal nations" (i.e., those untroubled by war, political instability, and government confiscation of wealth), the natural ongoing capitalization of new technologies apparently produces a net dilution of outstanding shares of slightly more than 2 percent a year. The Group 1 nations scarred badly by war represent a more fascinating phenomenon; they can be thought of as experiments of nature in which physical capital is devastated and must be rebuilt. Fortunately, destroying a nation's intellectual, cultural, and human capital is much harder than destroying its economy; within little more than a generation, the GDP and per capita GDP of war-torn nations catch up with, and in some cases surpass, those of the undamaged nations. Unfortunately, the effort requires a high rate of equity recapitalization, which is reflected in the substantial dilution seen in Table 1 for the war-torn countries. This recapitalization savages existing shareholders.

In short, the U.S. experience was not unique. Around the world, every one of these countries except Sweden experienced dividend growth sharply slower than GDP growth, and only two countries experienced dividend growth even slightly faster than per capita GDP growth. The U.S. experience was better than most and was similar to that of the other nations that were not devastated by war.

The data for the individual countries in Table 1 show that the average real growth in dividends was negative for most countries. It also shows that dilution of GDP growth (the fourth column) was substantial for all the countries studied and that dilution of per capita GDP growth (the last column) was substantial for most countries but fit dividend growth with much less "noise" than did the dilution of overall GDP growth.

This analysis has disturbing implications for "paradigmistas" convinced of the revolutionary nature of biotechnology, Internet, and telecommunications/broadband companies. A rapid rate of technological change may, in effect, turn "normal" Group 2 nations into strife-torn Group 1 nations: An increased rate of obsolescence effectively destroys the economic value of plant and equipment as surely as bombs and bullets, with the resultant dilution of per share payouts happening much faster than the technology-driven acceleration of economic growth—if such acceleration exists. How many of the paradigmistas truly believe that the tech revolution will benefit the shareholders of existing enterprises remotely as much as it can benefit the entrepreneurs creating the new enterprises that make up the vanguard of this revolution?

Whatever the true nature of the interaction of technological progress and per share earnings, dividends, and prices, it will come as an unpleasant surprise to many that even in the Group 2 nations, average real per share dividend growth was only 0.66 percent a year (rounded in Table 1 to 0.7 percent); for the war-torn Group 1 nations, it was disturbingly negative.

In short, the equity investor in a nation blessed by prolonged peace cannot expect a real return greatly in excess of the much-maligned dividend yield; the investor cannot expect to be rescued by more rapid economic growth. Not only is outsized economic growth unlikely to occur, but even if it does, its benefits will be more than offset by the dilution of the existing investor's ownership interest by technology-driven increased capital needs.

Big Lie #2: Stock Buybacks

Stock buybacks are attractive to companies and beneficial to investors. They are a tax-advantaged means of providing a return on shareholder capital and preferable to dividends, which are taxed twice. Buybacks have enormous appeal. But contrary to popular belief, they did not occur in any meaningful way in the 1990s.

To support this contention, we begin with a remarkably simple measure of slippage in per share earnings and dividend growth: the ratio of the proportionate increase in market capitalization to the proportionate increase in stock price. For example, if over a given period, the market cap increases by a factor of 10 and the cap-weighted price index increases by a factor of 5, a 100 percent net share issuance has taken place in the interim. Formally,

$$\text{Net dilution} = \left(\frac{1+c}{1+r}\right) - 1,$$

where c is capitalization increase and r is price return. This relationship has the advantage of factoring out valuation changes, which are embedded in both the numerator and denominator, and neutralizing the impact of stock splits. Furthermore, it holds only for universal market indexes, such as the CRSP 1–10 or the Wilshire 5000, because less inclusive indexes can vary the ratio simply by adding or dropping securities. **Figure 4** contains plots of the total market cap and price indexes of the CRSP 1–10 beginning at the end of 1925.

The CRSP data contained NYSE-listed stocks until 1962. Even the CRSP data, however, can involve adding securities: CRSP added the Amex stocks in July 1962 and the Nasdaq stocks in July 1972, which created artificial discontinuities on those dates. The adjustment for these shifts is evident in **Figure 5**, for which we held the dilution ratio constant during the two months in question.[3] Note how market cap slowly and gradually pulls away from market price. The gap does not look large in Figure 4, but by the end of 2001, the cap index had grown 5.49 times larger than the price index, suggesting that for every share of stock extant in 1926, 5.49 shares existed in late 2001. The implication is that net new share issuance occurred at an annualized rate of 2.3 percent a year. Note that this rate is identical to the average dilution for non-war-torn countries during the 20th century given in Table 1. To give a better idea of how this dilution has proceeded over the past 75 years, Figure 5 provides a dilution index, defined as the ratio of capitalization growth to price index growth.

Figure 4. CRSP 1–10 Market Cap and Price Indexes, 31 December 1925–June 2002

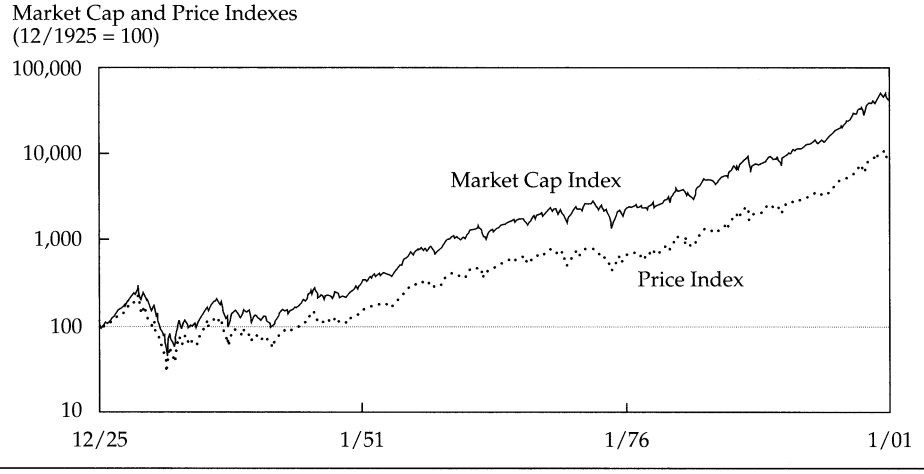


Figure 5. Cumulative Excess Growth of Market Cap Relative to Price Index, 31 December 1925 through June 2002

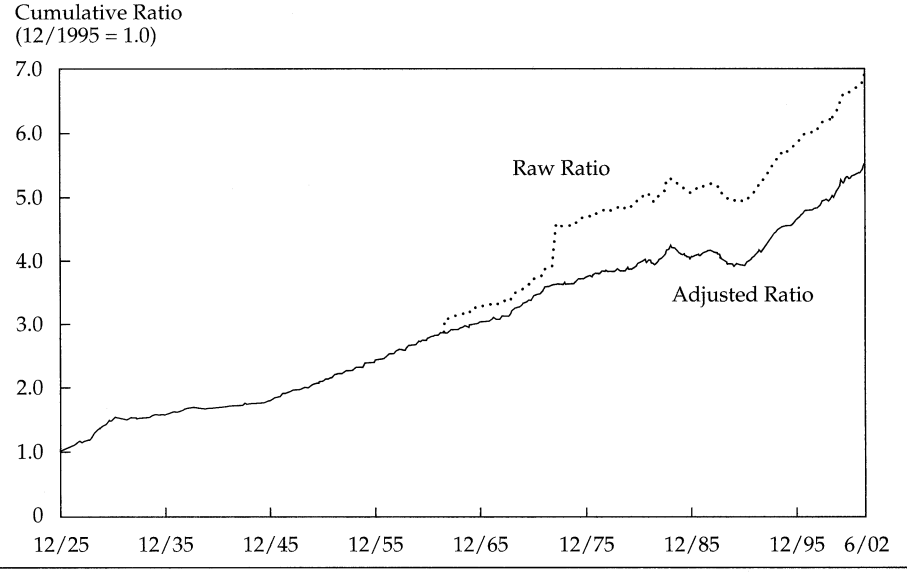
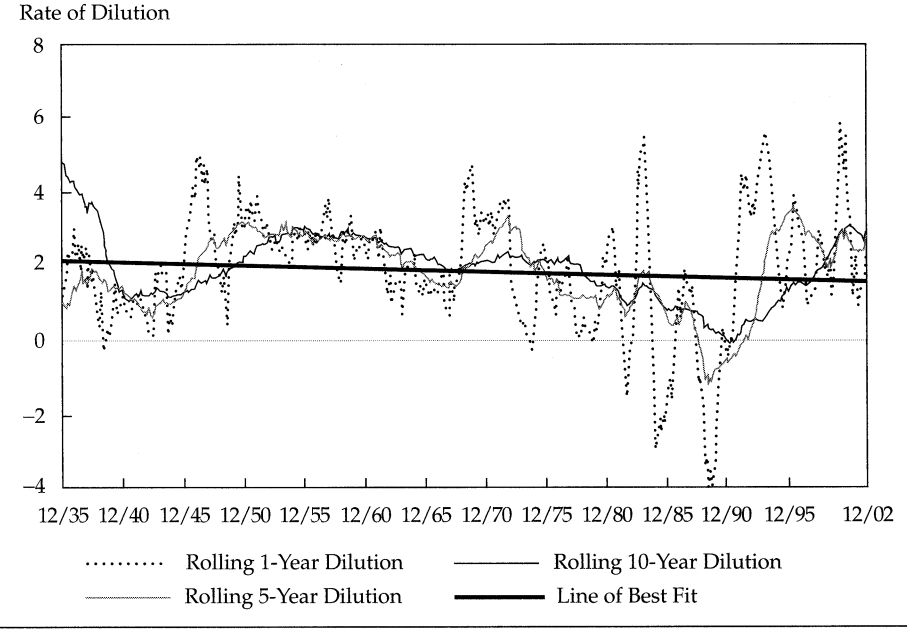


Figure 5 traces the growth in the ratio of the capitalization of the CRSP 1–10 Index as compared with the market-value-weighted price appreciation of these same stocks. The fact that this line rises nearly monotonically shows clearly that new-share issuance almost always sharply exceeds stock buybacks. The notable exception occurred in the late 1980s, when buybacks modestly outpaced new share issuance (evident from the fact that the line falls slightly during these "Milken years"). This development probably played a key role in precipitating the popular illusion that buybacks were replacing dividends. For a time, they did. But that stock buybacks were an important force in the 1990s is simply a myth. And belief in the myth may have been an important force in the bull market of the 1990s.

Figure 6 shows the rolling 1-year, 5-year, and 10-year dilution effect on existing equity shareholders as a consequence of a growth in the aggregate

Figure 6. Annualized Rate of Shareholder Dilution, 31 December 1935 through June 2002



supply of equity shares. Keep in mind that every 1 percent rise in equity capital is a 1 percent rise in market cap in which existing shareholders did not (could not) participate. Aside from the 1980s, this dilution effect on shareholders was essentially never negative—not even on a one-year basis. One can see how the myth of stock buybacks gained traction after the 1980s; even the 10-year average rate of dilution briefly dipped negative in the late 1980s. But then, during the late 1990s, stock buybacks were outstripped by new share issuance at a pace that was only exceeded in the IPO binge of 1926–1930. These conclusions hold true whether one is looking at net new share issuance on a 1-year, 5-year, or 10-year basis.

Those who argue that stock buybacks will allow future earnings growth to exceed GDP growth can draw scant support from history. Investors did see enormous earnings growth, far faster than real economic growth, from 1990 to 2000. But Figure 3 shows how tiny that surge of growth was in the context of 130 years of earnings history. Much of the earnings surge of the 1990s was dubious, at best.

The Eye of the Storm?

The big question today is whether the markets are likely to rebound into a new bull market or have merely been in the eye of the storm. We think the markets are in the eye.

The rapid earnings growth of the 1990s, which many pointed to as "proof" of a new paradigm, had several interesting characteristics:

1. A trough in earnings in the 1990 recession transformed into a peak in earnings in the 2000 bubble. Measuring growth from trough to peak is an obvious error; extrapolating that growth is even worse. This decade covered a large chunk of the careers of most people on Wall Street, many of whom have come to believe that earnings can grow very fast for a very long time. Part of conventional wisdom now is that earnings growth can outstrip macroeconomic growth.
2. Influenced by the new paradigm, analysts frequently ignored write-offs to focus increasingly on operating earnings. This practice is acceptable if write-offs are truly "extraordinary items," but it is not acceptable if write-offs become a recurring annual or biannual event, as was commonplace in the 1990s. Furthermore, what are extraordinary items for a single company are entirely ordinary for the economy as a whole. In some companies and some sectors, write-offs are commonplace. The focus on operating earnings for the broad market averages is misguided at best and deceptive at worst.
3. Those peak earnings of 1999–2000 consisted of three dubious components. The first is an underrecognition of the impact of stock options, which various Wall Street strategists estimated at 10–15 percent of earnings. The second is pension expense (or pension "earnings") based on assumptions of a 9.5 percent return, which were realistic then but are no longer; this factor pumped up earnings by approximately 15 percent at the peak and 20–30 percent from current depressed levels. The third component is Enron-style "earnings management," which various observers have estimated to be 5–10 percent of the peak earnings. (We suspect this percentage will turn out to be conservative.)

If these three sources of earnings overstatement (aggressive pension accounting, failure to expense management stock options, and outright fraud) are removed, the $54 peak earnings per share for the S&P 500 Index in 2000 turn out to be closer to $36. This figure implies normalized earnings a notch lower still. If the normalized earnings for the S&P 500 are in the $30–$36 range, as we suspect is the case, then the market at mid-year 2003 was still at a relatively rich 27–32 times normalized earnings. Using Shiller's (2000) valuation model (real S&P 500 level divided by 10-year average of real reported earnings) confirms this analysis. Shiller's model pegs the current multiple at nearly 30 times normalized earnings in mid-2003.

In principle, several conditions could allow earnings growth to exceed GDP growth. Massive stock buybacks are one. But we have demonstrated that buybacks in the 20th century were far more smoke than fire. Buybacks have been much touted as the basis for sustained earnings growth at unprecedented rates, but they simply do not show up in the data on market capitalization relative to market index price levels. Cross-holdings could also offer an interesting complication. But again, their impact does not show up in the objective shareholder dilution data. We have demonstrated that buybacks and cross-holdings do not yet show any signs of offsetting the historical 2 percent dilution, but the exploration of the possible impact of buybacks and cross-holdings is beyond the scope of this study.

Conclusion

Expected stock returns would be agreeable if dividend growth, and thus price growth, proceeded at the same rate as, or a higher rate than, aggregate economic growth. Unfortunately, dividends do not

grow at such a rate: When we compared the Dimson et al. 20th century dividend growth series with aggregate GDP growth, we found that even in nations that were not savaged by the century's tragedies, dividends grew 2.3 percent more slowly, on average, than GDP. Similarly, by measuring the gap between the growth of market cap and share prices in the CRSP database, we found that between 1926 and the present, a 2.3 percent net annual dilution has occurred in the outstanding number of shares in the United States.

Two independent analytical methods point to the same conclusion: In stable nations, a roughly 2 percent net annual creation of new shares—the Two Percent Dilution—leads to a separation between long-term economic growth and long-term growth in dividends per share, earnings per share, and share price.

The markets are probably in the eye of a storm and can expect further turmoil as the rest of the storm passes over. If normalized S&P 500 earnings are $30–$36 per share, if payout ratios on those normalized earnings are at the low end of the historical range (implying lower-than-normal future earnings growth), if normal earnings growth is really only about 1 percent a year above inflation, if stock buybacks have been little more than an appealing fairy tale, if the credibility of earnings is at an all-time low, and if demographics suggest Baby Boomer dis-saving in the next 20 years, then we have a problem.

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Notes

1. In calculating "trend growth," we used a loglinear line of best fit to minimize the impact of distortions from an unusually high or low starting or ending date. The loss years of 1932 and 1933 were excluded because of loglinear calculation.
2. The Dimson et al. book is a masterwork. If you do not have a copy, you should.
3. We assumed the dilution factor to be zero in those two months. If a massive stock buyback or a massive new IPO occurred during one of these two months, we may have missed it. But net buybacks or net new share issuance during months in which the "index" saw a major reconstitution would be difficult to measure.

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Professional Forecasts of Interest Rates and Exchange Rates: Evidence from the Wall Street Journal's Panel of Economists

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Abstract

We use individual economists' 6-month-ahead forecasts of interest rates and exchange rates from the *Wall Street Journal*'s survey to test for forecast unbiasedness, accuracy, and heterogeneity. We find that a majority of economists produced unbiased forecasts but that none predicted directions of changes more accurately than chance. We find that the forecast accuracy of most of the economists is statistically indistinguishable from that of the random walk model when forecasting the Treasury bill rate but that the forecast accuracy is significantly worse for many of the forecasters for predictions of the Treasury bond rate and the exchange rate. Regressions involving deviations in economists' forecasts from forecast averages produced evidence of systematic heterogeneity across economists, including evidence that independent economists make more radical forecasts.

JEL code: E47

Keywords: Forecast evaluation, interest rates, exchange rate

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Professional Forecasts of Interest Rates and Exchange Rates: Evidence from the Wall Street Journal's Panel of Economists

Professional forecasters' predictions of macroeconomic variables are of widespread interest. Governments, businesses, and households purchase forecasts, presumably to help them form their own expectations and aid in economic decision-making.[1] Economic researchers increasingly use surveys of professional forecasters' predictions as proxies of otherwise unobservable expectations in studying asset price determination.[2] But compared with the effort put into making macroeconomic forecasts, the effort put into assessing forecast quality ex post is small (Fildes and Stekler (2002), p 462).

Ex post assessments of forecast quality are potentially valuable to forecasters and users of forecasts alike. The theory of rational expectations implies that, if professional forecasters understand fundamental economic processes, they will produce unbiased, identical forecasts given access to the same information and presented with similar incentives with respect to forecast accuracy. If ex post assessments show forecasters' predictions to be unbiased and statistically identical, they serve to increase confidence in the profession's knowledge of economic processes, researchers' use of forecasts to proxy economic expectations, and agents' use of forecasts to inform economic decision-making. But if assessments yield evidence of bias or heterogeneity, they call for a reexamination of assumptions about information access, incentives and, possibly, understanding of economic processes.

[1] For example, Carroll (2003) reports evidence that households use the reported forecasts of professional economists in forming their own expectations.

[2] For example, Anderson et al (2003) and the references cited by them, discuss researchers' use of professional economists' forecasts of macroeconomic variables to distinguish expected from unexpected macroeconomic announcements in studies of financial market reactions to economic news. Frankel and Froot (1987) and MacDonald (2000) observe that forecasts of interest rates and exchange rates potentially enable researchers to separate the confounding effects of expectations and time-varying risk premiums.

Of the studies that assess forecast quality from survey data, most focus on inflation, GDP and exchange rate forecasts and several cast doubt on the rationality of forecasters (MacDonald (2000)). For example Ito (1990), using survey data of individual economists' exchange rate forecasts, finds evidence of heterogeneous expectations, as do MacDonald and Marsh (1996), who use individual economists' exchange rate forecasts from a different survey. Lamont (2002) finds that the patterns of economists' forecasts of real GDP, the unemployment rate and the inflation rate are inconsistent with the single goal of forecast accuracy, suggesting strategic behavior. Laster *et al.* (1999) also finds evidence of strategic behavior by forecasters making real GDP forecasts from survey data which groups forecasters by industry rather than identifying them individually, which raises the issue of how carefully survey participants make their predictions when they are not identified. Compared with inflation, GDP and exchange rate forecasting, interest rate forecasting has received less attention.

To help address the comparative dearth of forecast assessments and to contribute to the debate on forecaster rationality we analyze interest rate and exchange rate forecasts from a highly visible but relatively little studied survey of forecasters, the *Wall Street Journal's* panel of economists. This survey is particularly well-suited to assessing forecast quality because the names and employers of the forecaster-economists are published along side their forecasts, which should give the economists strong incentives to think carefully about their forecasts. We focus on interest rate and exchange rate forecasts because their actual values are never subject to subsequent revision, unlike, say GDP, so there is no question about the actual values economists were predicting.[3] In addition, the *Wall Street Journal* surveys contain consistent data on interest rate and exchange rate forecasts for a longer period than on other variables. We proceed by testing whether economists' forecasts are unbiased, more accurate than naïve prediction rules,

[3] Keane and Runkle (1990) present evidence that using preliminary versus revised data can change the conclusions from unbiasedness tests.

and heterogeneous or indicative of strategic behavior by economists. We study the forecasts of individual economists as well as the survey means, allowing for the possibility that the interest rates and exchanges rates forecasted are non-stationary. We are unaware of previous papers that allow for non-stationarity in the actual data when applying tests of forecast unbiasedness to individual data. We are also unaware of previous papers using interest rate and exchange rate forecasts from the *Wall Street Journal* survey to study forecast unbiasedness, assess the statistical significance of forecast accuracy, or investigate forecast heterogeneity and possibly strategic behavior by economists.

To preview our results, we find that a majority of economists produce forecasts that are unbiased and that most produce forecasts that are less accurate than the forecasts generated by a random walk model. While efficient financial markets should make accurate forecasting of interest rates or exchange rates impossible, rational forecasters should not do significantly worse than a random walk model. We find that the economists' forecasts exhibit the same kind of heterogeneity found by Ito (1990) and MacDonald and Marsh (1996), using Japanese and European survey data, respectively. When we apply the models of Laster *et al.* (1999) and Lamont (2002) to our economists' forecasts we find evidence of strategic behavior similar to Laster *et al,* but contrary to Lamont's finding that economists make more extreme forecasts as they age, we find that more experienced economists make less radical forecasts.

The rest of the paper is organized as follows. Section 1 briefly reviews some of the past work on evaluating survey measures of expectations. Section 2 describes our data. Section 3 reports our empirical results and section 4 offers some conclusions.

1. Review of Past Work

Although researchers have put less effort towards assessing professional economists' forecasts than seems warranted, the existing research focuses on three issues.[4] The first is whether mean or median responses, usually referred to as consensus forecasts, give misleading inferences about the unbiasedness and rationality of individual forecasters. Figlewski and Wachtel (1981) report that pooling individuals' inflation forecasts from the Livingston survey produces stronger evidence of bias than using survey averages. Keane and Runkle (1990) find that individuals' inflation forecasts from the Survey of Professional Forecasters (SPF) are generally unbiased whereas Bonham and Cohen (2001) find many of the forecasters in the SPF to be biased and systematically heterogeneous so that pooling their forecasts is inappropriate.[5] The finding of bias in inflation expectations runs contrary to rational expectations, and might reflect heterogeneity of expectations. Whether the individual forecasts of interest rates and exchange rates of professional economists are similarly plagued by bias is a question addressed below.

A second issue of research focus is whether the standard tests of economists' forecast unbiasedness are rendered invalid by nonstationarity in the variables economists' forecast.[6] Liu and Maddala (1992) find that exchange rate forecasts from the Money Market Services (MMS) survey appear to be nonstationary but cointegrated with the actual data and thus, potentially unbiased; when they introduce a restricted cointegration test they find that the forecasts are indeed unbiased. In contrast, Aggarwal *et al.* (1995) and Schirm (2003) find that only about half

[4] Much of the work on evaluating survey measures of expectations focuses on inflation forecasts. See Croushore (1998) and Thomas (1999) for reviews of this work. MacDonald (2000) examines previous work on financial market expectations.
[5] Bonham and Cohen (2001) test whether the coefficients of the standard unbiasedness equation are the same across individuals and reject this hypothesis. Batchelor and Dua (1991) use individual forecast data from the Blue Chip Economic Indicators and find that most individuals are unbiased.
[6] The standard test is to regress the actual value being forecasted on the forecast and test that the intercept is zero and the slope is one.

the macroeconomic variables forecasted by economists in the MMS surveys appear unbiased after testing for nonstationarity and cointegration.[7] But Osterberg (2000), applying the Liu-Maddala techniques to more recent exchange rate forecasts in the MMS survey, finds that these forecasts are unbiased. The aforementioned tests, it should be noted, all use the median responses from the MMS surveys rather than forecasts of individual economists. To our knowledge the issue of variable non-stationarity and forecast unbiasedness has not been investigated using forecasts by individual economists.

A third issue of research focus concerns forecast heterogeneity and strategic behavior by forecasters as a potential source of such heterogeneity. Study of this issue has been furthered by the availability of data reporting forecasts by individuals. Ito (1990) and MacDonald and Marsh (1996) use individual data and report evidence supporting systematically heterogeneous expectations about exchange rate movements. The latter paper also finds that variations in the degree of heterogeneity can help explain the volume of trading in financial markets. Scharfstein and Stein (1990) and Erbeck and Waldmann (1996) argue that the incentive structure facing forecasters leads to "herding," that is, making forecasts that are close to the mean or "consensus" forecast. In contrast, Laster *et al.* (1999) and Lamont (2002) suggest that incentives could lead forecasters to make forecasts that are more extreme than their true expectations if forecasters are rewarded not only for being right but for being right when others are wrong. Laster *et al* (1999) find evidence consistent with strategic forecasting using forecasts of real GDP from the Blue Chip Economic Indicators, although their data are not ideal for testing their theory since

[7] These variables include the consumer price index, the producer price index, the M_1 money supply, personal income, durable goods, industrial production, retail sales, the index of leading indicators, housing starts, the trade balance, and unemployment.

individual forecasters are not identified, only the industry of their employment.[8] Lamont (2002) uses *Business Week's* annual set of economists' forecasts for real GDP growth, inflation, and unemployment to test whether forecasters make more radical predictions when they own their own firms, and hence may gain the most from publicity. He finds support for this hypothesis, as well as evidence that forecasters produce forecasts that deviate more from the mean forecast as they age. Perhaps due to the paucity of data on interest rate and exchange rate forecasts by individuals, the issue of heterogeneity in interest rate forecasts and strategic behavior in forecasting interest rates and exchange rates remains largely unstudied.

To investigate the rationality, accuracy, and heterogeneity for individual forecasters' interest rate and exchange rate forecasts we use data from the *Wall Street Journal's* bi-annual survey of economists. Several researchers have used these data previously, mainly to examine forecast accuracy. Kolb and Stekler (1996) examine the six-month-ahead interest rate forecasts from 1982 through January 1990 and find little evidence that forecasters, individually or on average, can predict the sign of interest rate changes. Greer reports similar evidence for predicting the direction of one-year changes for various variables for 1984-1997 (Greer (1999)) and for the long-term interest rate for 1984-1998 (Greer (2003)). Cho (1996) evaluates the six-month-ahead predictions of twenty-four forecasters who participated in all the surveys from December 1989 through June 1994. He finds that about 80 percent of the forecasters predicted the short-term interest rate more accurately than a random walk model but that very few predicted the long-term interest rate or the exchange rate better than a random walk model. Eisenbeis *et al.* (2002) uses the *Wall Street Journal* data from 1986 to 1999 to illustrate a new approach to ranking forecasters across variables that differ in volatility and cross-correlation.

[8] Pons-Novell (2003), using Livingston survey data on forecasts of the unemployment rate, found support for industry effects as in Laster *et al.* (1999) but not the age effect found by Lamont(2002) . The Livingston data, however, do not identify the individual respondents by name.

But to our knowledge, researchers have not previously used the *Wall Street Journal* data to test for unbiasedness of individual forecasts or to test for strategic forecasting by individual forecasters.

After describing our data, we employ them to investigate the dominating issues in the recent work on expectations of economic variables: unbiasedness of individuals' forecasts, the implications of nonstationarity of the data for the accuracy of unbiasedness tests, and systematic heterogeneity of forecasts, possibly as a result of strategic behavior. In addition, we go beyond past researchers' use of the *Wall Street Journal* data by examining the statistical significance of the surveyed economists' forecast accuracy.

2. The *Wall Street Journal* survey data

Since 1981 the *Wall Street Journal* has published forecasts of several economic variables by a set of economists at the beginning and at the mid-point of each year. The economists are identified both by name and by employer. The survey is dominated by economists employed by banks and securities firms but it also includes representatives from non-financial industries, consulting and forecasting companies, universities and professional associations.[9] The initial survey presented economists' forecasts of the prime rate. In January 1982 the survey introduced forecasts of the Treasury bill and Treasury bond interest rates. Additional forecasts have been added including the CPI inflation rate, real GDP growth, and the dollar-yen exchange rate, among others. In the January survey economists are asked for their forecasts of the Treasury bill rate, Treasury bond rate, and the dollar-yen exchange rates for the last business day of June, and

[9] For respondents that appeared in at least six surveys from January 1982 through July 2002, the employer mix is as follows: banks (30 individuals and 394 observations), econometric modelers (5 and 108), independent forecasters (26 and 325), industrial corporations (5 and 41), securities firms (39 and 626), and others (10 and 154).

in the July survey they are asked for their forecasts for the last business day of December.[10] The surveys are published in the first week of January and July, along with commentary on the forecasts and, more recently, discussion of the accuracy of the last set of forecasts.[11]

In this paper we examine the six-month-ahead forecasts of the Treasury bill and Treasury bond rates that began in 1982 along with the six-month-ahead forecasts of the dollar-yen exchange rate that began in 1989. Our sample ends with the July 2002 survey. This long time period allows larger sample sizes for individual forecasters and a larger number of participants. We choose the interest rate and exchange rate variables both because they appear on the largest number of surveys and because the actual data are not revised so there is no question of what variable the forecasters were predicting.[12]

Table 1 reports the means and standard deviations of the survey responses along with the range, and number of respondents. The number of respondents varies over time: only twelve economists participated in the January 1982 survey compared with fifty-five in the July 2002 survey. There is also considerable turnover in the respondents themselves. Table 1 also reports the actual values for the Treasury bill rate, the Treasury bond rate, and the yen-dollar exchange rate on the last business day of June and December.

For several tests we restrict the sample to the set of respondents that made at least twenty forecasts. Table 2 reports the names, participation dates, and professional affiliations of these respondents from 1982 through 2002.

[10] Respondents have often been asked for 12-month ahead forecasts but these are not available for the entire period.
[11] The selection of survey respondents does not depend on their past performance. The *Journal* tries to get broad representation but also wants to include the chief economists from major financial institutions. We thank Jon Hilsenrath of the *Wall Street Journal* for this information.

[12] There was a change in the definition of the three-month Treasury bill rate from the discount yield to the bond-equivalent yield starting with the July 1989 survey. The long-term bond rate refers to the thirty-year bond until the July 2001 survey when it was changed to the ten-year rate. All data are available from the authors on request.

Figures 1-3 show the dispersion in the forecast errors, defined as actual minus predicted, of the Treasury bill rate, the Treasury bond rate, and the yen-dollar exchange rate. The figures are similar in showing a considerable spread in forecasts. The assumption that agents form unique rational expectations using the same model and same information is clearly not supported by the data. Figure 1 indicates that the errors in predicting the Treasury bill rate are largely of one sign for about half the surveys, suggesting that while expectations vary across individuals a common source exists for at least some of the error. Figures 2 and 3 provide stronger support for this interpretation, where an even higher proportion of the survey errors are of the same sign for the long-term bond rate and the exchange rate. The correlation coefficient for the two interest rate forecast errors is .66, indicating that most of the forecast errors are from unpredicted shifts in the yield curve rather than unpredicted changes in its slope. There is little evidence of correlation in the errors for interest rates and the exchange rate.[13]

3. Evaluating the survey data

3.1. Tests of unbiasedness

A major issue in the literature on economic expectations is unbiasedness, which is a requirement for rationality when a forecaster's loss function is symmetric about the forecast error. Denoting the forecast of a variable made at time (t-1) for time t as ${}_{t-1}F_t$ and the actual value of the variable as A_t, the usual test involves estimating

$$A_t = \alpha + \beta \, {}_{t-1}F_t + \varepsilon_t \qquad [1]$$

[13] For the forecast errors in the figures, the correlation between the Treasury bill forecast errors and the exchange rate errors is .02 and the correlation between the Treasury bond forecast errors and the exchange rate errors is –.07.

where ε_t is a random error term. A forecast series is unbiased if the joint hypothesis that $\alpha=0$ and $\beta=1$ cannot be rejected.[14]

As is well-known estimating [1] may produce misleading inferences when A and F are nonstationary and not cointegrated since the error term will also be nonstationary, resulting in the spurious regression problem noted by Granger and Newbold (1974). If the actual series is nonstationary, an unbiased forecast must also be nonstationary and the two series must be cointegrated with a cointegrating vector of zero and one. Liu and Maddala (1992) suggest a restricted cointegration test when A and F are I(1): impose the restrictions $\alpha=0$ and $\beta=1$ and use the data to compute forecast errors; if the forecast errors are stationary, the restrictions are supported and the forecasts are unbiased since the cointegrating vector is unique with only two series.[15] We perform the Liu-Maddala test below after first establishing whether A and F are I(1).

To establish that the As – the daily Treasury bill, Treasury bond and exchange rate data sampled at six-month intervals, the data frequency that matches our forecast series -- are I(1), we perform unit root tests. Using levels data we cannot reject the hypothesis of a unit root for any of the three series, but using first-differenced data we can reject the unit root hypothesis for all three. Thus all three actual series appear to be I(1).[16]

To establish that the Fs -- the Treasury bill, Treasury bond and yen-dollar exchange rate forecast series of the thirty-three economists listed in Table 2 who responded to at least 20 surveys -- are I(1), we perform 99 unit root tests (three forecast series for each of the thirty-three

[14] Rationality tests often include a test that ε_t is not autocorrelated and may also include other information available at time (t-1) on the right hand side of equation [1]. Rationality requires that all such variables have zero coefficients.
[15] Papers employing this restricted cointegration test include Hakkio and Rush (1989) and Osterberg (2000).

[16] The ADF statistics using 1 lag for the levels of the Treasury Bill rate, Treasury bond rate, and yen-dollar exchange rate are -.867, -.970, and -2.396 respectively, indicating that each series has at least one unit root. The ADF statistics for the first differences are -4.950, -6.143, and -3.612 indicating that all series are I(1). Rose (1988) and Rapach and Weber (2004) also find that the nominal interest rate has a unit root while Baillie and Bollerslev (1989) report similar findings for nominal exchange rates.

economists). The t statistics for augmented Dickey-Fuller (ADF) unit root tests performed on levels and first differences for individual forecasters are reported in the second column of Tables 3-5. Starred values indicate rejection of the unit root hypothesis at the 0.01, 0.05 or 0.10 levels of significance. Of the 99 forecast series, 71 appear to be I(1) using the 10% significance level or better.

To complete the Liu-Maddala test we impose the restriction that $\alpha=0$ and $\beta=1$ on [1], use the As and Fs to compute the forecast errors, and perform ADF tests to determine whether the forecast errors are I(0). The third columns in Tables 3-5 report ADF t statistics for the case of a zero intercept since the null hypothesis is that the residuals have an expected value of zero. Box-Ljung Q statistics to test for serial correlation in the residuals appear beneath the t statistics. Of the 99 forecast error series all but four are I(0) at the 10% level or better and only four show evidence of serially correlated errors.

To pass the Liu-Maddala test the Fs must be I(1) and the forecast residuals must be I(0). Nearly 60 % of the Treasury bill rate forecasts reported in Table 3 meet both criteria.[17] In addition, over three-quarters of the Treasury bond rate forecast series in Table 4 and two-thirds of the exchange rate forecast series in Table 5 meet both criteria.[18] Altogether, two-thirds (67) of the 99 forecast series pass the Liu-Maddala test of unbiasedness. Moreover, the three series of mean survey responses pass the Liu-Maddala test, as indicated in the last row of each table.

While the results of the Liu-Maddala tests are encouraging to proponents of forecaster rationality, Lopes (2000) provides evidence that the power of their restricted cointegration test

[17] About one-third of the forecast series appear to be I(0) despite the Treasury bill rate series being I(1). First differences of four other forecast series appear to be nonstationary even though the first difference of the Treasury bill rate series is stationary; the forecast errors in these four cases do appear stationary, however. For some individuals there are gaps, usually just one, in the forecast series. While Shin and Sarker (1993) find that occasional missing values do not change the asymptotic distribution of the standard Dickey-Fuller tests, our samples are small so that the results with a gap remain suspect.

[18] Of the eleven exchange rate forecast series that failed, three had ten or fewer observations.

may be low, as is usual with unit root tests. He uses Monte Carlo techniques to show that a more powerful test of unbiasedness in finite samples is a simple t-test for the hypothesis that a forecast series' mean forecast error is zero. Accordingly, we also report the mean forecast error and its t-statistic in column 4 of each table. We fail to reject at the 10% level the null hypothesis of unbiasedness for 73% of the Treasury bill forecast series, 67% of the Treasury bond forecast series, and 88% of the exchange rate forecast series.[19] Of the forecast series with test statistics that reject the null, all of the Treasury bill rate and exchange rate forecast series and about two-thirds of the Treasury bond rate forecast series err on the high side. Biased forecasts by some forecasters did not serve to impart bias to the survey mean forecasts, however: the average forecast errors of the survey mean forecasts were statistically indistinguishable from zero, implying unbiasedness.

In summary, about two-thirds of the forecast series appear to be statistically unbiased, as do all three series of mean survey responses. Economists whose forecasts appeared to be biased usually overestimated the 6-month-ahead level of the Treasury bill, Treasury bond or yen-dollar exchange rate, with overestimation occurring more frequently in predicting interest rates than exchange rates. Based on the t-tests for unbiasedness at the 10% level, about 60 % of the survey economists were statistically unbiased in their predictions of the Treasury bill, Treasury bonds and exchange rate; about 10% made biased forecasts of one of the three rates; and the remaining 30% made biased forecasts of two series. No economist made biased predictions of all three rates.[20]

[19] At the less stringent 5% level, 80%, 73% and 91%, respectively, of the Treasury bill, Treasury bond, and exchange rate series fail to reject the null of unbiasedness.

[20] If the less stringent 5% level is used to judge unbiasedness, 67% of the survey forecasters were statistically unbiased in their predictions of all three rates; about 6% made biased forecasts of one of the rates; and the remaining 27% made biased forecasts of two rates.

3.2 Measures of predictive ability

While unbiasedness is a requirement for rationality of forecasters with symmetric loss functions, predictive ability is a hallmark of forecasters who "know the true model" determining macroeconomic variables. We take two approaches to measuring predictive accuracy: first, we assess forecasters' success at predicting the direction of interest rate and exchange rate changes;[21] second, we compare forecasters' accuracy to the accuracy of a traditional benchmark, the random walk model without drift, and test whether the accuracy metrics are statistically different. Although previous researchers have employed the *Wall Street Journal* survey to assess predictive accuracy using one approach or the other (but not both), they reach contradictory conclusions.[22] Moreover, we are unaware of any previously published research using the *Wall Street Journal* survey that tests for statistical differences in the accuracy of individual economists' forecasts versus forecasts of the random walk model.

In our first approach to predictive accuracy we use standard techniques to assess economists' accuracy in predicting the direction of change in the Treasury bill rate, Treasury bond rate, and yen-dollar exchange rate over 6-month intervals. The results appear in columns five and six of Tables 3-5. Column 5 reports the fraction of correctly-predicted changes along with the p-value for Fisher's exact test of the hypothesis that predicted and actual changes were independent. Column 6 reports the standard χ^2 statistic and the Pesaran-Timmerman (1992) test

[21] Leitch and Tanner (1991) argue that the direction of change is more closely related to profits than say the mean square error for interest rate predictions.
[22] Kolb and Stekler (1996) and Greer (1999, 2003) present tests of directional change whereas Cho (1996) compares economists' forecast errors against the forecast errors made by the naïve model of no change. Kolb and Stekler and Greer find that little evidence that economists can predict the direction of change, whereas Cho finds that eighty percent of the economists outperformed the naive model when forecasting the Treasury bill rate.

statistic, also with a χ^2 distribution with 1 degree of freedom, of the same independence hypothesis.[23]

The directional accuracy tests suggest that the surveyed economists provide no useful information.[24] In forecasting the Treasury bill rate about two-thirds of economists predicted the direction of change correctly more than half the time, but for no economist was the percentage of correctly predicted directions significantly greater than expected by chance; moreover for a few, the percentage was significantly lower. In predicting the Treasury bond rate, only about one-third of economists forecasted directional change correctly more than half the time; nevertheless, few predicted directional change less accurately than chance. The surveyed economists were more successful in predicting directional change in the yen-dollar exchange rate: about 80 predicted correctly more than half the time; nevertheless none predicted correctly more often than would be expected by chance. Finally, the survey means successfully predicted the direction of Treasury bill rate and exchange-rate changes about as accurately as chance, but predicted the direction of Treasury bond rate changes significantly more poorly than chance. Thus, when set the task of predicting the direction of interest rate and exchange rate changes, the surveyed economists acquit themselves modestly, at best.

In our second approach to predictive accuracy, we compare the accuracy of the surveyed economists' predictions to the accuracy of a model predicting that interest rates and exchange rates follow a random walk without drift. Specifically, we computed the ratio of the mean square errors (MSEs) of each economist's forecast series to the MSEs of forecast series covering the

[23] For each forecaster we constructed a contingency table with the number of times the forecaster predicted a decline and there was a decline, the number of times the forecaster predicted an increase and there was an increase, the number of times the forecaster incorrectly predicted a decrease, and the number of times the forecaster incorrectly predicted an increase.

[24] We also performed the test of Cumby and Modest (1987), suggested by Stekler and Petrei (2003), in which the actual change is regressed on a binary variable taking the value of one if the forecaster predicted an increase and zero otherwise. These tests, not reported, also indicated that the respondents were unable to provide useful information on the direction of change.

same dates but using as forecasts the six-month-earlier actual values (that is, actuals on the last business day in December and June, respectively, to forecast values for the last business day in June and December, respectively; these actuals are usually published along side the forecasts in the *Wall Street Journal)*. The question becomes whether individual economists can outperform the random walk model by achieving a ratio less than one. In addition to analyzing this ratio we follow the recommendation of Fildes and Stekler (2002) and test for statistically significant differences between individuals' forecasts and random walk forecasts of no change using the modified Diebold-Mariano (1995) test statistic proposed by Harvey *et al.* (1997). Specifically, this statistic tests whether the mean difference between the squared forecast errors of the economist and of the random walk model is significantly different from zero; this statistic has a t-distribution under the null hypothesis that the mean is zero. We report our results in Tables 3-5. The next-to-the last column reports the number of forecasts made by each economist together with the sum of the squared forecast errors. The last column reports the ratio of each economist's MSE to the MSE from a random walk model and the Diebold-Marino statistic in parentheses.

The statistical evidence indicates that economists generally fail to beat and tend to be statistically less accurate than the random walk model. Although in predicting the Treasury bill rate eight of thirty-three economists achieve a MSE ratio less than one, the Diebold-Marino statistics indicate that no economist forecasts significantly better than the random walk model (i.e. a t-statistic that is significantly less than zero) and five do significantly worse at the 10% level. In predicting the Treasury bond rate, no economist achieved a MSE ratio less than one; moreover, about two-thirds of economists predicted significantly worse than a random walk model, judging by the Diebold-Marino statistics (i.e., a t-statistic significantly greater than zero). Accuracy in predicting the yen-dollar exchange was little better: no economist achieved a MSE ratio less than one, and half predicted significantly worse than a random walk model, judged by

the Diebold-Marino statistics. Economists' poor predictive ability is reflected in the survey mean predictions. Although survey mean predictions of the Treasury bill rate achieve a MSE ratio less than one, the survey mean predictions do not differ statistically from the random walk predictions. Survey mean predictions of neither the Treasury bond rate nor the yen-dollar exchange rate achieved MSE ratios less than one, and although the mean predictions of the Treasury bond rate did not differ statistically from the random walk predictions, the mean exchange-rate predictions were significantly worse than the random walk predictions.

Taken all together, the evidence on predictive ability suggests that agents who use forecasts and prize accuracy would have suffered less disappointment by assuming that interest rates and exchange rates stay at their last observed levels rather than by relying on forecasts from the *Wall Street Journal* survey. The dismal predictive accuracy of many of the economists leads us to ask whether the forecasts are systematically heterogeneous, possibly because some economists face incentives to forecast large interest rate and exchange rate changes.

3.3. Tests of systematic heterogeneity of forecasts

Professional economists who are rational, who know the "true model," and who, in addition, have access to the same macroeconomic information relevant to forecasting interest rates and exchange rates – as a priori reasoning suggests is probably the case – should produce homogenous (identical) forecasts. In this section we examine whether forecasts of the economists in the *Wall Street Journal* survey are homogeneous or systematically heterogeneous.

To test for homogeneity in forecasts we follow Ito (1990), who posits a fixed-effects model. Ito models the forecast for time t of the j^{th} economist, $f_{j,t}$, as being a function of common information, I_t, an individual effect represented by an individual-specific dummy variable, g_j, and a random error term, $u_{j,t}$:

$$f_{j,t} = f(I_t) + g_j + u_{j,t} . \quad [2]$$

Ito assumes further that $f(I_t)$ contains a constant so that the average of the g_js may be set to zero. Averaging equation [2] across all economists and then subtracting the average from [2] yields:

$$f_{j,t} - f_{AVE,t} = g_j + (u_{j,t} - u_{AVE,t}) . \quad [3]$$

Homogeneity of forecasts can be tested by estimating [3] on forecast data for individual economists and testing that the estimated values of g_j are identical across economists.[25] [26]

Table 6 presents the results from estimating [3] using the Treasury bill rate, Treasury bond rate and the yen-dollar exchange rate forecasts of the economists in the *Wall Street Journal* survey and testing for forecast homogeneity. Like Ito (1990) we estimate [3] twice, first letting the g_js represent dummy variables for individual economists and again letting the g_js represent dummy variables for the economists' sector of employment. Panels A and B, respectively, report results from the two estimations. We report results for two sub-samples of economists, one including all economists having at least six survey responses (Panel 1) and another including all economists having at least twenty responses (Panel 2), the same economists whose forecasts were examined in sections 3.1 and 3.2.[27]

The evidence in Table 6 overwhelmingly rejects the hypothesis of homogeneous forecasts. In Panel A, F tests reject the null hypothesis of identical g_j estimates for all economists at the 0.01 level for all the data sets, indicating the presence of significant individual effects. In

[25] An essentially identical approach is to regress the individual forecasts on a set of time dummies as well as a set of individual dummies and test for individual effects.

[26] Ito uses [3] to test for heterogeneity in exchange rate forecasts made by Japanese economists. He finds that the data reject the hypothesis of homogeneous forecasts both when the g_js are individual dummy variables and when the g_js represent the industry of the economist's employment. Ito also finds that economists employed in export industries have a depreciation bias whereas those employed in the import business have an appreciation bias, a pattern he terms the "wishful thinking" effect. MacDonald and Marsh (1996) also find evidence of heterogeneity across exchange rate forecasters from a large survey of European economists. In addition they report that the dispersion of forecasts is positively related to the volume of foreign exchange trading. MacDonald and Marsh report that the European economists are generally less accurate than a random walk for 3-month predictions but that a substantial number of economists beat a random walk when making 12-month forecasts.

[27] These are unbalanced panels since participants change over time.

Panel B, coefficient estimates of five employment sectors appear (top number, standard errors beneath) along with F tests of the null hypothesis that the estimated coefficients are identical (reported in the last row). The data soundly reject the null for all data sets. The coefficient estimates indicate that, compared with other economists, independent forecasters made significantly lower forecasts of the Treasury bill and Treasury bond rate and significantly higher forecasts of the yen-dollar exchange rate. Economists employed by securities firms also made comparatively low forecasts of the Treasury bond rate, but not as low as economists employed by independent firms. Economists affiliated with banks produced forecasts statistically indistinguishable from the consensus, as did economists employed by econometric modeling firms, except for yen-dollar exchange rate forecasts made by Panel 2, which were statistically lower.

In summary, the evidence from the *Wall Street Journal* survey suggests that the economists' forecasts are indeed systematically heterogeneous. This finding leads us to investigate whether individual forecasters behave strategically in making their forecasts.

3.4. Tests of strategic forecasting

Laster *et al.* (1999) and Lamont (2002) suggest that the incentive structure facing professional economists potentially motivates them to supply heterogeneous forecasts. Specifically, they argue that if economists are rewarded both for forecast accuracy and for "standing out from the crowd," economists may announce more extreme predictions than if they were rewarded for forecast accuracy alone.[28] To investigate this possibility we estimate a model combining elements of Lamont (2002) and Laster *et al.* (1999):

[28] Lamont (2002) models forecasters' payoff function as follows:
$w_j = R(|f_j - a|, |f_j - f_{c(-j)}|)$

$$|f_j - f_{c(-j)}|_t = \beta_0 + \beta_1 AGE_{j,t} + \beta_2 AGE_{j,t}* MODEL_{j,t} + \beta_3 AVEDEV(-j)_t$$

$$+ \beta_4 OWN_{j,t} + \sum \gamma_i D_{i,t} + \varepsilon_{j,t} \quad [4]$$

Following Lamont our dependent variable – a measure of "standing out from the crowd" – is the absolute value of the difference between an individual economist's time t forecast and the average time t forecast omitting that economist's forecast. AGE is the number of years an economist had participated in the *Wall Street Journal* survey at the time of survey t while the interaction term AGE*MODEL allows the effect of an economist's age to differ if the economist is employed by an econometric modeling firm.[29] AGE is included to control for changing incentive structures: incentives might encourage young forecasters to make extreme forecasts so as to gain publicity while encouraging older forecasters to make less extreme forecasts so as to protect the reputations; alternatively, incentives might encourage young forecasters to make less extreme forecasts so as to hide their inexperience while encouraging seasoned, secure forecasters to make more radical forecasts. AVEDEV(-j) is the average absolute deviation of the forecasts from the mean, omitting the j^{th} economist; this latter variable controls for variations in the spread of the forecasts over time. The dummy variable, OWN, equals one if an economist is employed at a firm that bears his name. Finally, following Laster *et al.*, we add dummy variables for the industry employing the j^{th} economist at the time of survey t, the D_{jt}s. Our industries include banks, securities firms, finance departments of corporations, econometric modelers, and economists employed by independent firms not bearing the economists' names, similar to Laster

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where w_j is the payoff to forecaster the j^{th} forecaster, $|f_j - a|$ is the absolute value of the j^{th} forecaster's forecast from the actual value, and $|f_j - f_{c(-j)}|$ is the absolute value of the j^{th} forecaster's forecast from the consensus forecast, omitting the j^{th} forecaster's forecast. Lamont assumes the partial derivative of R with respect to the first argument, R_1, is negative: inaccurate forecasts reduce a forecaster's payoff. But he allows that the partial derivative of R with respect to the second argument, R_2, is an empirical question.

[29] Lamont found that this variable was important and that the effect of age was not significant for forecasts from econometric models.

et al. The hypothesis that economists behave strategically is supported by statistically significant coefficients on AGE, AGE*MODEL, OWN, and the D_{jt}s, as well as by statistical differences among the estimated coefficients of the D_{jt}s.

Table 7 presents estimates of [4] using the Treasury bill rate, Treasury bond rate and the yen-dollar exchange rate forecasts of the economists in the *Wall Street Journal* survey. As in the previous section we report estimates for two sub-samples of economists, one including all economists having at least six survey responses (Panel 1) and another including all economists having at least twenty responses (Panel 2), the same economists whose forecasts were examined in sections 3.1 and 3.2.

The Table 7 estimates show overwhelming evidence of strategic behavior by economists in the form of statistically significant estimated coefficients of AGE, OWN and several of the D_{jt}s, as well as statistical differences among the D_{jt}s. The estimated coefficients of AGE are negative and usually statistically significant, implying that economists make less extreme forecasts the longer they are surveyed.[30] This age effect holds for all economists including those employed by econometric modeling firms, since the estimated coefficient of AGE*MODEL never achieves significance. Though pervasive, the estimated age effects are small in absolute terms: compared with a first-time respondent, an economist in the survey for 10 years (20 surveys) is about 4 basis points closer to the mean interest rate forecast and a little less than one yen closer to the mean exchange rate forecast. Larger in absolute terms is the effect of employment by a forecasting firm bearing one's name: forecasts of such economists deviate more from the mean forecasts than forecasts of other economists by amounts ranging from 13 to

[30] As noted above, the *Wall Street Journal* does not systematically drop forecasters with poor records so a negative coefficient should not be due to a survivorship bias. It is possible, however, that people who make extreme and inaccurate forecasts drop out to avoid negative publicity. We also estimated a model with age and AVEDEV(-j) as explanatory variables for each of the individuals listed in Table 2. Age was statistically significant at the .10 level for only about one-third of the panel and was negative in most cases. No individual had significantly positive coefficients on age for all three variables being forecasted.

22 basis points for the interest rates and 1.7 yen, on average, for the exchange rate. The name effect appears to drive economists' strategic behavior rather than independence per se: only in forecasting the Treasury bond rate did economists employed by independent firms named for others make forecasts statistically more extreme than the consensus, and even then the effect was absolutely small. Surveyed economists employed by banks appeared to make less extreme forecasts than other economists, judging from the consistently negative and statistically significant estimated coefficients of Banks. Economists employed by securities firms, corporations and econometric modeling firms also tended to make less extreme forecasts, judging from the generally negative although inconsistently significant estimated coefficients of their respective dummy variables. When the hypothesis that economists' forecasts deviated equally from the consensus regardless of employment is tested, F statistics soundly and universally reject the hypothesis. Because it seems unlikely that economists in different industries had differential access to the macroeconomic data needed to make interest rate and exchange rate forecasts, we conclude that incentive structures encourage economists employed in different industries to supply heterogeneous forecasts, with economists from firms bearing their own names being more likely to make extreme forecasts because they gain the most from being right when others are wrong.[31]

3.5 Discussion of results

We believe that the results presented in sections 3.1 – 3.4 present a consistent story. Our findings from section 3.1 – that 30% of economists produced biased forecasts, generally in the upward direction – and from section 3.2 – that economists generally failed to forecast as

[31] We also estimated equation [4] allowing for individual fixed effects or individual random effects. These models gave similar estimates for the effects of AGE and AVEDEV but wiped out the statistical significance of the industry effects. Since individuals change industries occasionally in our sample, as indicated in Table 2, the industry differences appear to be captured by the individual effects.

accurately as the random walk model and sometime forecasted less accurately – is consistent with the heterogeneity of forecasts we found in section 3.3. When we tested for evidence of strategic behavior by economists in section 3.4 by using a synthesis of the Lamont (2002) and Laster *et al.* (1999), we obtained some results similar to theirs. Like Lamont and Laster *et al.* we found that economists from independent firms tend to make more extreme forecasts and, like Lamont, we found that economists whose firms bear their names make forecasts that consistently deviate more from the survey mean than other economists. But whereas Lamont found evidence that economists make more extreme forecasts the longer they are surveyed, we found the opposite to be true: the estimated coefficients of AGE are consistently negative and usually statistically significant.

Although our results on strategic behavior bear some similarities to Lamont and Laster *et al.*'s, we believe it is important to note the advantages of the *Wall Street Journal* survey data on interest rates and exchange rates for testing strategic behavior compared with *Business Week* survey data used by Lamont and the Blue Chip Economic Indicators data used by Laster *et al.* Although the *Business Week* survey publishes forecasts of economists by name, Lamont studied economists' forecasts of real GDP growth, inflation and unemployment, all of which are subject to revision, which raises the issue of which values economists were forecasting. Laster *et al.* also study economists' forecasts of real GDP growth, so the caveats that apply to Lamont apply to Laster *et al.* as well. In addition, the Blue Chip Indicators data Laster *et al.* use groups forecasters by industry rather than identifying them individually; hence the incentives to forecast strategically are not as strong.

Our finding that the *Wall Street Journal's* panel of economists cannot predict changes in interest rates and exchange rates more accurately than a random walk model is not surprising,

given the efficiency of financial markets. What is perhaps surprising is that so many of the panel forecast significantly worse than the random walk model. The explanation of these results we favor is that many of the economists face incentives that reward the exceptionally right guess but do not equally penalize the exceptionally wrong guess. An alternative explanation is that even if the economists know the random walk model to be more accurate over time, this leaves them with no story to spin about their forecasts. Always telling customers that you predict no change in interest rates or exchange rates may simply be too truthful to keep one employed.

4. Conclusions

While widespread public interest in forecasts of macroeconomic variables has led professional economists to put considerable effort in generating forecasts, less effort has gone into assessing the quality of these forecasts. The theory of rational expectations implies that professional economists' forecasts should be unbiased and identical given access to the same information and similar incentives with respect to predictive accuracy. Previous studies employing survey data of professional economists' forecasts to assess forecast quality have tended to lack comprehensiveness, suffer from data problems, or produce inconclusive results.

This paper has sought to help fill the void by using semi-annual survey data from the *Wall Street Journal'*s panel of economists to study interest rate and exchange rate forecasts of individual economists. We found that while about 60% of the surveyed economists produced unbiased estimates, virtually all failed to make 6-month ahead forecasts of the Treasury bill rate, Treasury bond rate and yen-dollar exchange rate that beat a naïve random walk model for accuracy, and many made forecasts significantly less accurate than the random walk model. When we tested for homogeneity of interest rate and exchange rate forecasts, we found them to be systematic heterogeneous. In particular, we found that independent economic forecasters (those not employed by banks, security firms, corporations' finance departments, or econometric

model firms) made significantly lower forecasts of the Treasury bill rate and Treasury bond rate and significantly higher forecasts of the yen-dollar exchange rate. Evidence of systematically heterogeneous forecasts led us to consider whether economists faced economic incentives to produce heterogeneous forecasts. When we estimated an incentives model combining elements of models estimated by Lamont (2002) and Laster *et al.* (1999), we found evidence that economists who would be expected to gain the most from favorable publicity – those employed by firms named for them – make more extreme forecasts, whereas economists employed by other institutions tend to make more conservative, less extreme forecasts. We found no evidence that economists become more radical with age. If anything, experienced economists appear to preserve their reputations by deviating less from the consensus forecast than inexperienced economists.

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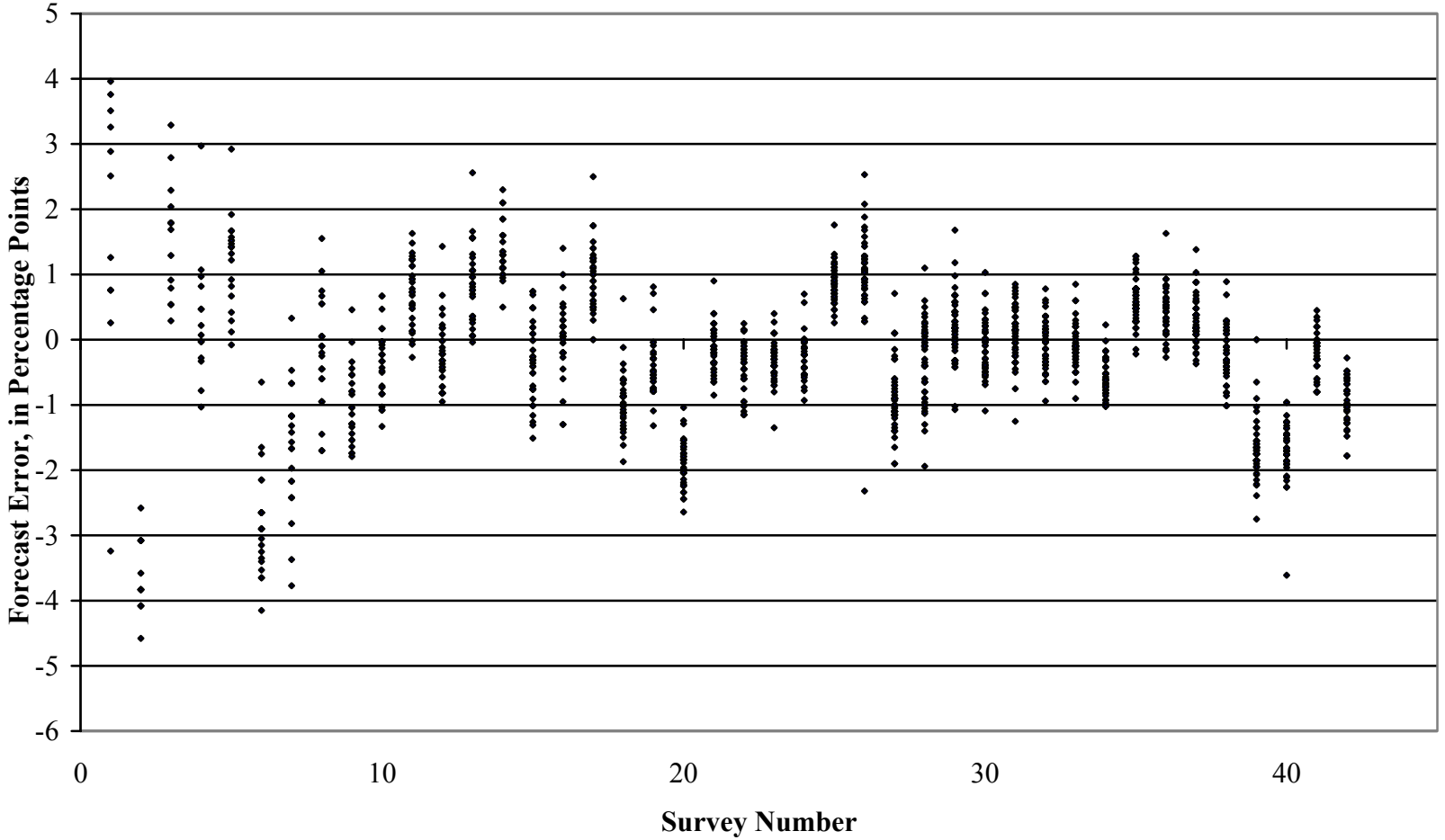
Figure 1

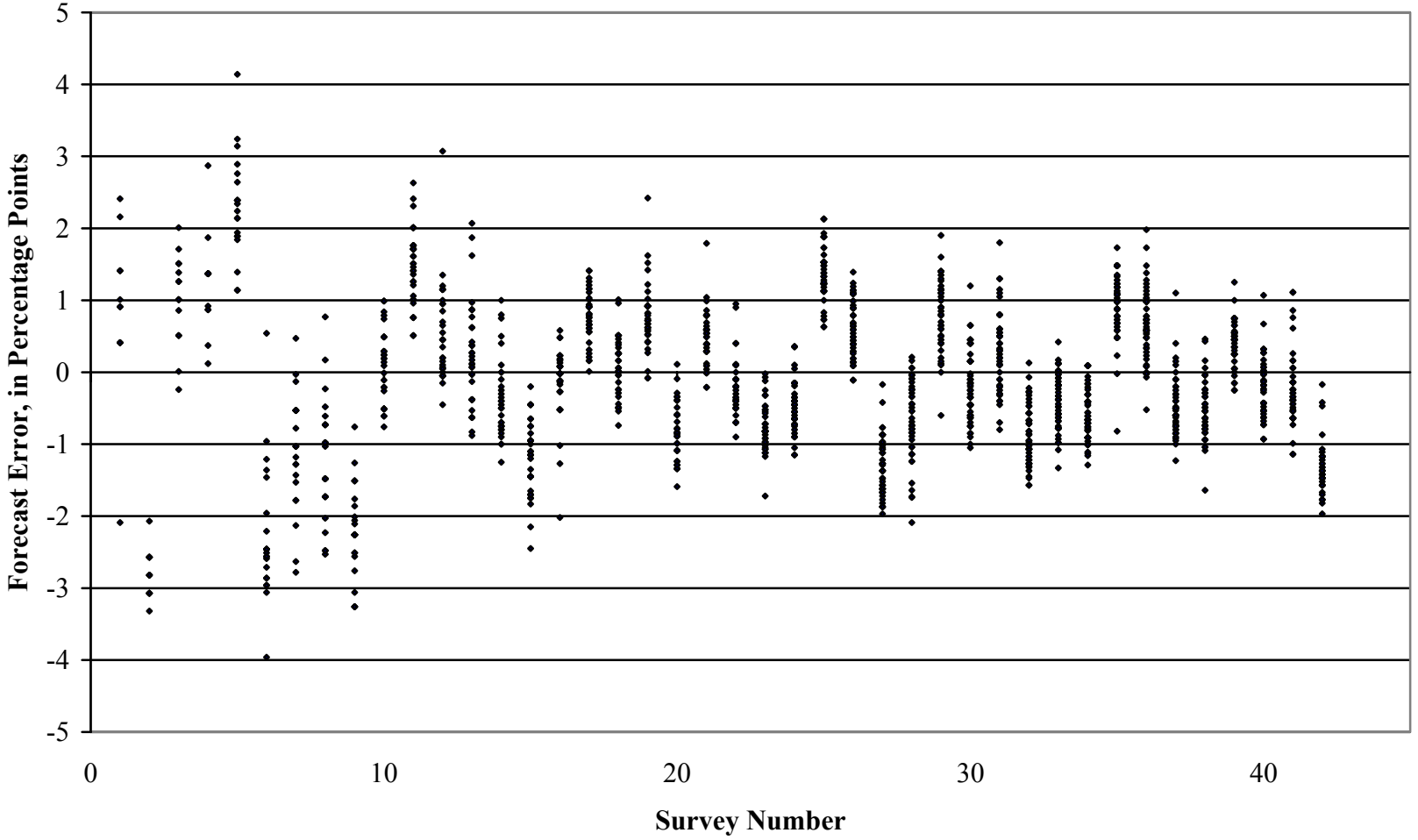
Forecast Errors of the Treasury Bill Rate



Note: Forecast errors are measured as the actual rate minus forecasters' predictions on the survey date, six months earlier. Forecast errors are shown for the 42 surveys beginning with January 1982 and ending with July 2002.

Figure 2

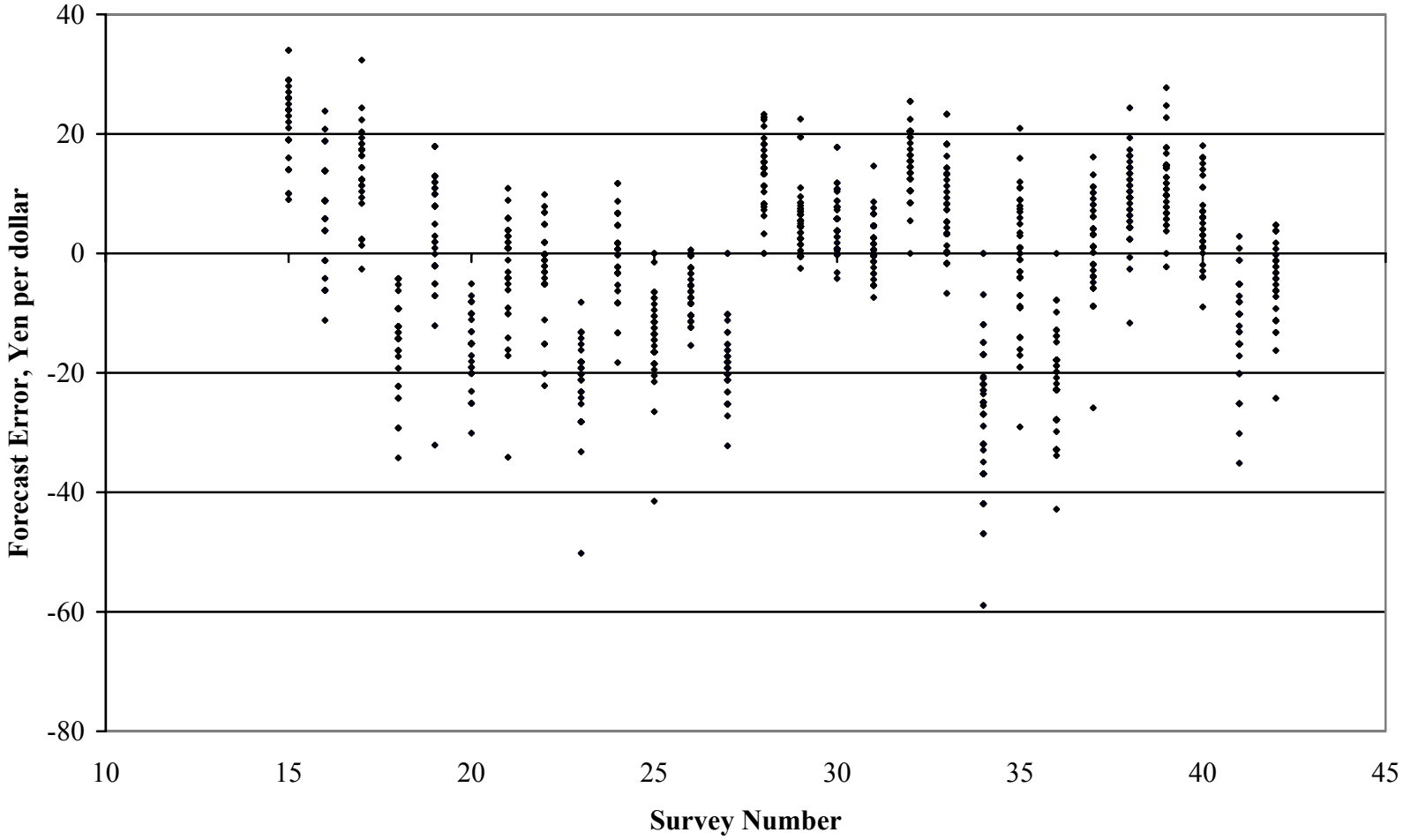
Forecast Errors for theTreasury Bond Rate



See notes to Figure 1.

Figure 3

Forecast Errors for the Yen-Dollar Exchange Rate



Note: Forecasts of the yen-dollar exchange rate were added to the *Wall Street Journal* survey in January 1989. Forecast errors are shown for the 28 surveys from January 1989 to July 2002, which correspond to survey numbers 15-24 in our sample.

Table 1
Summary Statistics for Survey Forecasts

Survey Date	Treasury bill Rate			Treasury bond Rate			Yen-Dollar Rate		
year_mo	Mean S.D.	Range N	Actual	Mean S.D.	Range N	Actual	Mean S.D.	Range N	Actual
1982_01	11.06 2.05	8.8-16 12	12.76	13.05 1.13	11.5-16 12	13.91			
1982_07	11.61 .54	10.5-12.5 14	7.92	13.27 .35	12.5-13.75 14	10.43			
1983_01	7.37 .94	5.5-9.625 17	8.79	10.11 .71	9-11.625 17	11.01			
1983_07	8.60 .89	6-10 17	8.97	10.59 .60	9-11.75 17	11.87			
1984_01	8.72 .64	7-10 24	9.92	11.39 .68	9.5-12.5	13.64			
1984_07	10.62 .76	8.5-12 24	7.85	13.75 .85	11-14.75 24	11.54			
1985_01	8.56 .98	6.5-10.6 24	6.83	11.60 .80	10-13.25 24	10.47			
1985_07	7.31 .82	5.5-8.75 25	7.05	10.51 .83	8.5-11.8 25	9.27			
1986_01	6.96 .58	5.5-7.75 25	5.96	9.45 .63	8-10.5 25	7.24			
1986_07	6.02 .51	5-7 30	5.67	7.41 .51	6.5-8.25 30	7.49			
1987_01	4.98 .48	4.1- 6 35	5.73	7.05 .53	5.88-8 35	8.51			
1987_07	5.91 .50	4.25-6.63 35	5.68	8.45 .66	5.88-9.4 35	8.95			
1988_01	5.70 .58	4-6.6 36	6.56	8.65 .71	6.8-9.75 36	8.87			
1988_07	6.78 .39	5.8-7.6 32	8.1	9.36 .56	8-10.25 32	9			
1989_01	8.29 .60	7.25-9.5 38	7.99	9.25 .49	8.25-10.5 38	8.05	121.37 6.15	110-135 38	144
1989_07	7.76 .52	6.4-9.1 38	7.8	8.12 .48	7.4-10 38	7.98	136.53 8.47	120-135 38	143.8
1990_01	7.03 .48	5.5-8 40	8	7.62 .35	7-8.4 40	8.41	137.78 6.81	120-155 40	152.35
1990_07	7.56 .43	6-8.5 40	6.63	8.16 .40	7.25-9 40	8.26	149.78 7.14	140-170 40	135.75
1991_01	6.14 .42	4.9-7.03 40	5.71	7.65 .46	6-8.5 40	8.42	133.65 9.69	120-170 40	137.9
1991_07	5.84 .35	5-6.6 40	3.96	8.22 .38	7.3-9 40	7.41	140.78 5.61	130-155 40	124.9
1992_01	3.80 .34	2.75-4.5 42	3.65	7.30 .37	6-8 42	7.79	127.64 8.07	115-160 42	125.87
1992_07	3.54 .39	2.9-4.3 42	3.15	7.61 .38	6.45-8.3 42	7.4	127.33 7.07	115-147 42	124.85
1993_01	3.41 .32	2.7-4.45 44	3.1	7.44 .33	6.7-8.4 44	6.68	127.70 7.07	115-157 44	106.8

Table 1, continued

Survey Date	Treasury bill Rate			Treasury bond Rate			Yen-Dollar Rate		
year_mo	Mean S.D.	Range N	Actual	Mean S.D.	Range N	Actual	Mean S.D.	Range N	Actual
1993_07	3.34 .31	2.37-4 44	3.07	6.84 .35	5.99-7.5 44	6.35	112.16 6.44	100-130 44	111.7
1994_01	3.40 .28	2.5-4 51	4.26	6.26 .38	5.5-7 51	7.63	113.10 5.90	100-140 49	98.51
1994_07	4.67 .60	3.15-8 58	5.68	7.30 .39	6.5-8.1 58	7.89	106.85 3.69	99-115 52	99.6
1995_01	6.50 .49	4.89-7.5 59	5.6	7.94 .38	6.8-8.6 59	6.63	104.09 4.00	95-117 57	84.78
1995_07	5.44 .56	4-7.04 62	5.1	6.61 .52	5.75-8.05 62	5.96	89.23 4.24	80-100 60	103.28
1996_01	4.98 .45	3.5-6.25 64	5.18	6.03 .44	5-7.5 64	6.9	104.71 4.56	87-112 62	109.48
1996_07	5.31 .40	4.18-6.3 58	5.21	6.86 .47	5.45-7.7 58	6.65	109.99 4.25	98-120 56	115.77
1997_01	5.16 .41	4.4-6.5 57	5.25	6.52 .52	5-7.6 57	6.8	113.45 4.15	100-122 55	114.61
1997_07	5.41 .35	4.58-6.3 55	5.36	6.79 .40	5.8-7.5 55	5.93	114.89 4.66	105-125 54	130.45
1998_01	5.18 .30	4.25-6 56	5.1	6.02 .37	5.2-6.95 56	5.62	130.41 7.03	115-145 54	138.29
1998_07	5.08 .25	4.25-5.5 55	4.48	5.72 .36	5-6.38 55	5.09	141.28 10.38	120-172 53	113.08
1999_01	4.20 .33	3.5-5 54	4.78	5.05 .44	4.25-6.8 54	5.98	122.77 9.93	100-150 52	120.94
1999_07	4.89 .34	3.7-5.6 54	5.33	5.83 .48	4.5-7 54	6.48	124.75 7.19	110-145 53	102.16
2000_01	5.58 .35	4.5-6.25 53	5.88	6.38 .40	4.8-7.13 53	5.9	105.32 7.20	90-132 53	106.14
2000_07	6.11 .41	5-6.9 53	5.89	6.01 .39	5-7.1 53	5.46	105.34 5.94	90-126 53	114.35
2001_01	5.36 .38	4.3-6.4 52	3.65	5.35 .31	4.5-6 54	5.75	113.21 5.39	97-127 53	124.73
2001_07	3.39 .42	2.7-5.35 54	1.74	5.28 .40	4-6 54	5.07	126.48 6.18	113-140 54	131.04
2002_01	1.89 .32	1.25-2.5 55	1.7	5.06 .51	3.75-6 55	4.86	132.76 7.34	117-115 55	119.85
2002_07	2.19 .33	1.5-3 54	1.22	5.21 .36	4-6.25 55	3.83	123.58 6.53	110-143 55	118.75

Note: Survey respondents are asked early in January and July for their forecasts for the last business day of July and December, respectively. The mean, standard deviation (S.D.) and range of the forecasts in each survey are shown. The number of respondents (N) varies across surveys. The actual values of the variables forecasted are shown in the "Actual" column.

Table 2
Participants Responding To At Least Twenty Surveys

Person	Firm	start	end	gaps	missing dates
David Berson	Fannie Mae	199001	200207	0	
Paul Boltz	T. Rowe Price	198401	199801	0	
Philip Braverman		198401	199901	0	
	Briggs Schaedle	198401	198807		
	Irving Securities	198901	198907		
	DKB Securities	199001	199901		
Dewey Daane	Vanderbilt Univ.	198807	200207	0	
Robert Dederick	Northern Trust	198607	199607	0	
Gail Fosler	Conference Board	199101	200207	0	
Maury Harris		198607	200207	0	
	Paine Webber Inc.	198607	200007		
	UBS Warburg	200107	200207		
Richard Hoey		198401	199401	1	199107
	A.G. Becker	198401	198407		
	Drexel Burnham	198501	199101		
	Dreyfus Corp.	199201	199401		
Stuart G. Hoffman	PNC Bank, Fin Serv	198801	200207	1	199401
William Hummer		199301	200207	0	
	Wayne Hummer	199301	199707		
	Hummer Invest.	199807	200207		
Edward Hyman		198301	200207	1	198901
	C.J. Lawrence	198301	199107		
	ISI Group	199201	200207		
Saul Hymans	Univ. of Michigan	198607	200207	0	for yen:199407 199607 199807 199901
David Jones	Aubrey G. Lanston	198201	199301	0	
Irwin Kellner	ManuHan-Chem-Chase	198201	199701	1	198407
Carol Leisenring	CoreStates Finl.	198707	199801	0	
Alan Lerner		198201	199307	1	198401
	Bankers Trust	198201	199207		
	Lerner Consulting	199301	199301		
Mickey Levy		198507	200207	0	
	Fidelity Bank	198507	199107		
	CRT Govt. Securities	199201	199307		
	NationsBank Cap. Mk	199401	199807		
	Bank of America	199901	200207		
Arnold Moskowitz		198401	200007	1	198807
	Dean Witter	198401	199107		
	Moskowitz Capital	199201	200007		
John Mueller	LBMC	199107	200207	2	199401 199507
Elliott Platt	Donaldson Lufkin(DLJ)	198807	200001	1	199207
Maria Ramirez		199207	200207	1	199401
	Ramirez Inc.	199207	199307		
	MF Ramirez	199407	200107		
	MFR	200201	200207		
Donald Ratajczak		198701	200101	0	
	Georgia State Univ.	198701	200001		
	Morgan Keegan	200007	200101		
David Resler		198407	200207	0	
	First Chicago	198407	198701?		
	Nomura Securities I	198707	200207		
Alan Reynolds		198607	200001	1	199501
	Polyconomics	198607	199107		
	Hudson Institute	199201	200001		
Richard Rippe		199001	200207	0	
	Dean Witter	199001	199107		
	Prudential Securities	199201	200207		

Table 2, continued
Participants Responding To At Least Twenty Surveys

Person	Firm	start	end	gaps	missing dates
Norman Robertson		198201	199601	1	199407
	Mellon Bank	198207	199207		
	Carnegie Mellon	199301	199601		
A. Gary Shilling	Shilling & Co.	198201	200207	4	198307 198401 198901 198907
Alan Sinai		198201	200207		198807 199707
	Data resources	198207	198307		
	Lehman Bros Shearson	198401	198801		
	The Boston Co.(Lehman)	198901	199207		
	Economic Advisors Inc (Lehman)	199301	199307		
	Lehman Brothers	199401	199701		
	WEFA Group	199801	199801		
	(Primark) Decision Economic	199807	200207		
James Smith		198701	200207	2	198807 199401
	UT-Austin	198701	198801		
	Univ. of N.C.	198901	199901		
	Natl Assn of Realtors	199907	200001		
	Univ. of N.C.	200007	200207		
Donald Straszheim		198607	200207	11	198807 199707-200201
	Merril Lynch	198607	199701		
	Strszheim Global Advisors	200207	200207		
Raymond Worseck	A.G. Edwards	198901	199901	0	
David Wyss		198401	200207	4	198807 199407(yen) 200001-200101
	Data Resources	198401	199907		
	Standard & Poor's (McGraw-Hill)	200107	200207		
Edward Yardeni		198607	200007	1	198807
	Prudential Bache	198607	199107		
	C.J. Lawrence	199201	199507		
	Deutsche Bank	199601	200007		

Table 3
Unbiasedness and Accuracy of Treasury Bill Rate Forecasts

Individual	Liu-Maddala Restricted CointegrationTest of Unbiasedness ADF(forecast) ADF(Δforecast)	 ADF(error) Q(4)	Mean Forecast Error and t-test for Unbiasedness	Fraction of Correct Directions (p-value for independence test)[a]	χ^2 and Pesaran-Timmerman Tests of Independence[b]	Accuracy Σ (A-F)^2 n	 MSE Ratio to Random Walk (Modified DM statistic)[c]
David Berson	-3.149** -3.030**	-2.426** 4.260	-.351 (-2.369)**	.577 (.453)	.735 .765	17.488 26	.877 (-.754)
Paul Boltz	-2.720* -2.833*	-2.901*** .541	-.460 (-2.257)**	.517 (.694)	.348 .361	39.928 29	1.929 (1.810)*
Phillip Braverman	-3.768*** -3.931***	-4.680*** 1.696	.203 (1.027)	.483 (.368)	1.178 1.217	37.695 31	1.780 (1.225)
Dewey Daane	-2.289 -3.632**	-2.775*** 2.200	-.382 (-2.584)**	.517 (.694)	.348 .361	21.981 29	.984 (-.066)
Robert Dederick	-1.559 -2.984**	-2.758*** 2.752	-.084 (-.477)	.524 (1.000)	.029 .031	13.270 21	1.008 (.039)
Gail Fosler	-3.171** -4.061***	-3.313*** 6.633	-.514 (-2.776)**	.542 (.653)	.697 .728	25.241 24	1.402 (1.370)
Maury Harris	-1.571 -3.275**	-3.185*** 2.009	-.092 (-.639)	.545 (.728)	.308 .318	22.264 33	.958 (-.211)
Richard Hoey	-1.660 -2.334	-2.290** 3.560	-.425 (-1.765)*	.350 (.613)	.848 .892	25.598 20	1.674 (1.698)
Stuart G. Hoffman	-1.954 -3.870***	-3.245*** .842	-.164 (-1.043)	.621 (.264)	1.830 1.896	20.978 29	.966 (-.160)
William Hummer	-2.047 -2.516	-1.819* 2.019	-.380 (-2.190)**	.600 (.582)	1.250 1.316	14.282 20	1.038 (.220)
Edward Hyman	-1.784 -4.026***	-4.399*** 6.248	.289 (1.672)	.564 (.706)	.416 .427	47.690 39	1.515 1.076
Saul Hymans	-2.545 -3.900***	-2.828*** 8.681	-.196 (-1.210)	.455 (.733)	.203 .209	28.911 33	1.245 (2.010)*
David Jones	-1.701 -4.117***	-2.770*** 4.205	-.316 (-.882)	.391 (.400)	1.245 1.301	67.325 23	1.533 (1.052)
Irwin Kellner	-3.635** -4.854***	-4.828*** 1.172	-.102 (-.421)	.333 (.141)	3.274* 3.387*	51.619 30	1.190 (1.480)
Carol Leisenring	-1.669 -3.114**	-2.430** 3.773	.025 (.147)	.455 (1.000)	.188 .197	12.913 22	.982 (-.081)
Alan Lerner	-1.765 -5.333***	-3.887*** 6.775	-.583 (-1.990)*	.652 (.221)	1.806 1.888	51.187 23	1.188 (.505)
Mickey Levy	-2.409 -4.476***	-3.810*** 3.691	-.152 (-.991)	.514 (1.000)	.000 .000	28.724 35	1.175 (.888)

Arnold Moskowitz	-2.800* -4.842***	-3.934** 3.671	-.078 (-.425)	.333 (.072)*	4.332** 4.468**	36.167 33	1.863 (1.512)
John Mueller	-2.937* -3.442**	-2.221** 3.907	-.310 (-1.512)	.238 (.030)**	5.743** 6.030**	26.525 21	1.711 (.996)
Elliott Platt	-2.725* -3.202**	-3.248*** 2.597	.077 (.461)	.522 (1.000)	.034 .035	14.410 23	1.092 (.379)
Maria Ramirez	-2.117 -2.585	-1.692* 1.803	-.374 (-2.678)**	.600 (.319)	1.684 1.772	10.209 20	.810 (-.593)
Donald Ratajczak	-2.023 -3.382**	-3.022*** .705	-.135 (-.939)	.586 (.462)	.909 .941	17.279 29	.897 (-.506)
David Resler	-2.485 -4.057***	-4.401*** 3.540	-.099 (-.629)	.514 (1.000)	.036 .037	33.284 37	1.117 (.658)
Alan Reynolds	-1.331 -2.891*	-1.995** 7.928	.104 (.569)	.519 (1.000)	.030 .031	23.776 27	1.662 (1.711)*
Richard Rippe	-3.192** -3.667**	-2.583** 1.481	-.349 (-2.185)**	.577 (.428)	1.009 1.049	19.738 26	.990 (-.051)
Norman Robertson	-2.562 -4.123***	-3.836*** 3.265	-.207 (-.841)	.571 (.701)	.289 .300	47.190 28	1.034 (.133)
A. Gary Shilling	-3.126** -5.300***	-3.388*** 2.056	.338 (1.446)	.553 (1.000)	.080 .082	80.992 38	1.428 (1.110)
Alan Sinai	-2.086 -4.320***	-4.063*** 5.303	-.278 (-1.459)	.525 (1.000)	.102 .105	59.551 40	1.075 (.292)
James Smith	-2.660 -3.588**	-2.577** 9.800*	.202 (.882)	.467 (.358)	1.701 1.760	46.689 30	2.415 (2.560)**
Donald Straszheim	-1.035 -1.936	-2.347** 2.171	-.076 (-.465)	.524 (1.000)	.002 .002	12.906 22	1.171 (.169)
Raymond Worseck	-2.049 -2.828*	-2.390** 1.238	-.291 (-1.619)	.524 (.656)	.404 .424	15.336 21	1.464 (1.657)
David Wyss	-2.208 -3.958***	-4.242*** 2.417	-.210 (-1.301)	.559 (.728)	.215 .222	30.722 34	1.336 (1.180)
Edward Yardeni	-1.928 -3.110**	-2.626*** .868	.254 (1.626)	.393 (.102)	4.044* 4.194*	20.197 28	1.690 (2.339)**
Survey Mean	-2.647 -4.950***	-4.309*** 1.709	-.223 (-1.318)	.524 (1.000)	.096 .098	51.444 42	.891 (-557)

Notes:
***, **, * signify statistical significance at the .01, .05, and .10 levels

[a] The number in parentheses is the significance level of the test for independence of predicted and actual changes using the Fisher exact test.

[b] These are Chi-square statistics for the test of independence of predicted and actual changes, see Pesaren and Timmerman (1992)

[c] The modified DM test is the modification of the Diebold-Mariano (1995) test of differences in squared forecast errors given in Harvey *et al* (1997).

Table 4
Unbiasedness and Accuracy of Treasury bond Rate Forecasts

Individual	Liu-Maddala Restricted Cointegration Test of Unbiasedness ADF(forecast) ADF(Δforecast)	 ADR(error) Q(4)	Mean Forecast Error and t-test for Unbiasedness	Fraction of Correct Directions (p-value for independence)	χ^2 and Pesaran-Timmerman Tests of Independence	Forecast Accuracy $\Sigma (A-F)^2$ / n	 MSE Ratio to Random Walk (Modified DM statistic)
David Berson	-1.424 -5.626***	-4.789*** 8.454	-.163 (-1.074)	.269 (.043)**	5.110** 5.310**	15.612 26	1.388 (2.963)***
Paul Boltz	-3.171** -3.529**	-2.857*** 2.837	-.455 (-2.216)**	.414 (.669)	.232 .240	40.280 29	1.664 (2.199)**
Phillip Braverman	-5.037*** -4.235***	-3.891*** 1.226	.269 (1.298)	.581 (1.000)	.057 .059	42.084 31	1.664 (1.377)
Dewey Daane	-2.382 -6.463***	-4.107*** 4.773	-.490 (-3.254)***	.310 (.164)	2.653 2.748	25.412 29	2.088 (2.431)**
Robert Dederick	-1.894 -4.943***	-4.993*** 4.133	-.046 (-.254)	.409 (.659)	.833 1.458	13.946 21	1.533 (2.216)**
Gail Fosler	-1.312 -4.553***	-2.392** 7.005	-.590 (-3.742)***	.500 (.615)	.825 .861	22.078 24	1.999 (2.187)**
Maury Harris	-1.191 -4.870***	-5.221*** 8.784	.095 (.713)	.545 (1.000)	.021 .021	19.213 33	1.426 (1.668)
Richard Hoey	-2.140 -2.535	-2.602** 11.496**	-.443 (-1.414)	.300 (.160)	3.039* 3.199*	41.128 20	2.135 (2.274)**
Stuart G. Hoffman	-1.695 -5.522***	-4.168*** 4.667	-.183 (-1.462)	.345 (.128)	3.131* 4.137**	13.755 29	1.304 (1.942)*
William Hummer	-1.631 -4.453***	-3.236*** 10.435*	-.387 (-2.434)**	.300 (.290)	1.832 1.928	12.605 20	1.300 (1.354)
Edward Hyman	-1.501 -5.486***	-4.109*** 7.866	.501 (2.743)***	.538 (1.000)	.030 .031	59.230 39	2.123 (1.801)*
Saul Hymans	-1.402 -5.948***	-5.403*** 12.111**	-.186 (-1.390)	.455 (1.000)	.122 .520	20.005 33	1.486 (2.073)*
David Jones	-2.074 -3.742**	-3.124*** 2.073	-.276 (-1.006)	.478 (1.000)	.048 .050	39.840 23	1.252 (.967)
Irwin Kellner	-2.579 -7.460***	-4.899*** 7.124	-.159 (-.767)	.433 (.272)	2.143 2.217	38.332 30	1.190 (.676)
Carol Leisenring	-1.522 -6.388***	-5.804*** 8.473	-.010 (-.067)	.591 (.655)	.282 .002	10.413 22	1.175 (.941)
Alan Lerner	-2.183 -4.813***	-3.882*** 4.164	-.523 (-1.921)*	.652 (.685)	1.806 .320	43.875 23	1.525 (2.129)**
Mickey Levy	-2.581 -7.662***	-6.895*** 5.468	-.088 (-.571)	.514 (1.000)	.008 .150	28.397 35	1.471 (2.153)**

Arnold Moskowitz	-2.831* -6.454***	-5.387*** 5.660	.012 (.055)	.424 (.278)	1.636 1.688	45.956 33	1.764 (1.706)*
John Mueller	-1.397 -4.429***	-1.842* 7.100	-.362 (-2.035)*	.381 (.361)	1.527 1.604	16.028 21	1.796 (2.154)**
Elliott Platt	-2.569 -4.903***	-4.729*** 4.268	.069 (.385)	.435 (.680)	.434 .454	16.210 23	1.593 (2.221)**
Maria Ramirez	-1.435 -5.654***	-2.077** 4.222	-.456 (-3.708)***	.350 (1.000)	.019 .020	9.906 20	1.206 (.949)
Donald Ratajczak	-1.152 -4.745***	-5.111*** 5.544	-.092 (-.634)	.310 (.067)*	3.948** 5.798**	17.389 29	1.469 (2.948)***
David Resler	-3.229** -4.704***	-4.442*** 3.581	.018 (.105)	.541 (.687)	.315 1.016	37.129 37	1.510 (2.558)**
Alan Reynolds	-1.482 -3.878***	-2.964*** 2.142	.204 (1.229)	.407 (.420)	1.187 1.232	20.397 27	2.031 (2.778)**
Richard Rippe	-1.196 -6.679***	-3.391*** 3.371	-.137 (-.911)	.308 (.105)	3.718** 3.867**	15.103 26	1.343 (1.472)
Norman Robertson	-2.248 -4.483***	-4.526*** 3.287	-.201 (-.828)	.286 (.030)**	5.320** 5.517**	45.725 28	1.254 (2.124)**
A. Gary Shilling	-2.636* -5.943***	-3.083*** 2.280	.534 (2.754)***	.553 (1.000)	.011 .011	63.702 38	1.761 (2.111)**
Alan Sinai	-2.275 -5.397***	-5.222*** 4.684	-.027 (-.146)	.500 (.730)	.234 .240	51.929 40	1.293 (1.299)
James Smith	-1.391 -5.143***	-4.429*** 3.802	.604 (3.431)***	.600 (1.000)	.599 .620	37.865 30	3.222 (2.228)**
Donald Straszheim	-1.120 -4.352***	-4.463*** 5.540	.004 (.021)	.476 (1.000)	.043 .046	15.843 22	1.560 (2.291)**
Raymond Worseck	-.587 -4.222***	-3.240*** 2.295	-.177 (-.972)	.429 (.659)	.531 1.458	14. 601 21	1.503 (1.803)*
David Wyss	-3.683** -4.514***	-4.753*** 3.412	-.137 (-.831)	.294 (.032)**	6.103** 6.287**	31.063 34	1.147 (.906)
Edward Yardeni	-1.152 -5.295***	-3.493*** 7.406	.575 (3.896)***	.536 (1.000)	.778 .807	25.757 28	2.182 (2.346)**
Mean	-2.459 -5.832***	-5.570*** 7.109	-.135 (-.832)	.333 (.024)**	6.133** 6.283**	46.418 42	1.132 (1.072)
Notes: See notes to Table 3							

Table 5
Unbiasedness and Accuracy of Yen-Dollar Exchange Rate Forecasts

Individual	Liu-Maddala Restricted Cointegration Test of Unbiasedness		Mean Forecast Error and t-test for Unbiasedness	Fraction of Correct Directions (p-value for independence)	χ^2 and Pesaran-Timmerman Tests of Independence	Forecast Accuracy	
	ADF(forecast) ADF(Δforecast)	ADF(error) Q(4)				Σ (A-F)^2 n	MSE Ratio to Random Walk (Modified DM statistic)
David Berson	-2.504 -3.589**	-2.721*** 1.681	-3.118 (-1.133)	.385 (.217)	2.275 2.366	5175.980 26	1.518 (2.452)**
Paul Boltz	-1.122 -2.735*	-2.120** 4.258	2.563 (.841)	.474 (1.000)	.003 .003	3301.963 19	1.397 (1.930)*
Phillip Braverman	-2.007 -3.097**	-2.847*** 1.481	-.204 (-.072)	.667 (.198)	2.291 2.405	3404.713 21	1.113 (.381)
Dewey Daane	-2.105 -3.535**	-3.209*** 3.265	2.873 (.996)	.393 (.441)	1.011 1.048	6518.140 28	1.729 (2.012)*
Robert Dederick	-.791 -2.042	-2.185** 3.752	1.146 (.320)	.563 (1.000)	.152 .163	3109.605 16	1.518 (1.921)*
Gail Fosler	-3.116** -3.357**	-2.699** 3.660	2.701 (.918)	.542 (.653)	.697 .728	4957.834 24	1.621 (1.828)*
Maury Harris	-1.917 -3.212**	-2.695** 3.536	-2.724 (-1.078)	.571 (.698)	.324 .336	5034.540 28	1.336 (1.642)
Richard Hoey	-1.370 -2.073	-1.984** 3.865	4.253 (.786)	.500 (1.000)	.000 .000	2685.864 10	2.170 (2.201)**
Stuart G. Hoffman	-1.874 -2.827*	-2.980*** 3.403	-1.251 (-.474)	.444 (.448)	.759 .788	4941.500 27	1.374 (2.028)*
William Hummer	-1.755 -2.847*	-2.432** 2.423	.240 (.080)	.550 (1.000)	.135 .142	3451.686 20	1.197 (1.400)
Edward Hyman	-2.179 -3.404**	-2.260** 2.403	-5.529 (-2.225)**	.543 (.569)	.675 .701	5159.600 27	1.513 (2.025)*
Saul Hymans	-1.982 -2.312	-2.291** 3.291	1.873 (.789)	.458 (1.000)	.084 .088	3194.330 25	1.055 (.593)
David Jones	-.792 -1.962	-1.722* 2.238	.136 (.028)	.444 (1.000)	.225 .253	1648.664 9	1.364 (2.071)*
Irwin Kellner	-1.135 -3.155**	-2.831*** 3.259	3.762 (1.191)	.647 (.294)	2.082 2.212	2955.657 17	1.442 (1.056)
Carol Leisenring	-1.138 -1.606	-1.947* 4.245	-.385 (-.134)	.526 (1.000)	.003 .003	2809.424 19	1.190 (.904)
Alan Lerner	-1.537 -2.670*	-.814 2.892	-7.008 (-1.372)	.500 (1.000)	.476 .529	2839.654 10	2.301 (2.358)**
Mickey Levy	-1.842 -3.257**	-2.598** 4.886	-3.438 (-1.435)	.607 (.560)	.778 .867	4672.100 28	1.239 (1.350)

Arnold Moskowitz	-1.373 -2.827*	-2.315** 2.750	-2.802 (-.960)	.583 (.673)	.243 .358	4893.624 24	1.399 (1.635)
John Mueller	-2.405 -2.739*	-2.550** 3.444	2.911 (1.063)	.524 (.659)	.311 .327	3329.745 21	1.311 (.826)
Elliott Platt	-1.764 -3.366**	-2.376** 3.983	-1.493 (-.495)	.636 (.384)	1.352 1.416	4245.175 22	1.239 (1.331)
Maria Ramirez	-2.369 -2.784*	-2.648** 6.150	-2.993 (-.920)	.500 (1.000)	.159 .167	4202.448 20	1.550 (1.908)*
Donald Ratajczak	-1.683 -3.186**	-3.075*** 3.363	2.600 (.927)	.400 (.653)	.329 .343	4886.268 25	1.357 (1.716)*
David Resler	-1.673 -3.116**	-2.991*** 4.052	-1.367 (-.580)	.536 (1.000)	.050 .052	4245.559 28	1.126 (1.132)
Alan Reynolds	-1.309 -2.814*	-2.296** 2.255	-.762 (-.279)	.591 (.666)	.627 .657	3470.269 22	1.082 (.466)
Richard Rippe	-2.688* -3.759***	-2.942*** 1.791	.305 (.118)	.577 (.453)	.735 .765	4343.981 26	1.275 (1.621)
Norman Robertson	-.327 -2.730*	-2.072** 2.063	-.216 (-.058)	.571 (1.000)	.286 .308	2517.032 14	1.254 (1.109)
A. Gary Shilling	-2.298 -3.653**	-1.483 2.917	-13.233 (-3.983)***	.538 (1.000)	.763 .793	11728.621 26	3.441 (3.582)***
Alan Sinai	-2.613 -3.434**	-2.506** 3.374	-1.653 (-.554)	.519 (1.000)	.008 .008	6320.800 27	1.796 (1.654)
James Smith	-1.800 -4.013***	-1.616 3.248	-11.881 (-4.713)***	.630 (.407)	1.511 1.569	9506.039 27	2.644 (2.294)**
Donald Straszheim	-1.093 -3.058**	-3.770*** 4.067	1.350 (.476)	.588 (.620)	.701 .745	2237.738 18	1.092 (.293)
Raymond Worseck	-1.305 -3.308**	-1.530 6.685	-3.109 (-1.003)	.571 (.673)	.269 .283	4235.650 21	1.385 (1.297)
David Wyss	-2.522 -3.551**	-2.805*** 2.847	.080 (.024)	.542 (1.000)	.168 .175	6049.966 24	1.693 (3.278)***
Edward Yardeni	-1.578 -2.717*	-2.302** 2.356	-4.860 (-1.810)*	.667 (.163)	3.055 3.187	4546.241 24	1.300 (1.360)
Mean	-1.941 -3.147**	-2.838*** 3.596	-1.529 (-.645)	.464 (.687)	.491 .509	4594.172 28	1.219 (2.114)**
Notes: See notes to Table 3							

Table 6
Tests of Heterogeneity of Forecasts Across Survey Respondents

Dependent variable: Deviation of an individual's time t forecast from the mean time t forecast

Data set	Panel 1[3]			Panel 2[4]		
Number of forecasters	93	93	79	33	33	33
Number of forecasts	1650	1650	1280	924	924	722
Forecast variable	T-Bill rate	T-Bond rate	Yen/$ rate	T-Bills rate	T-Bonds Rate	Yen/$ Rate
Panel A: Models with Individual Dummy Variables						
Tests for individual effects[1]	4.09***	8.63***	6.76***	5.96***	15.38***	12.23***
Panel B: Models with Employment Dummy Variables						
Banks	-.009 (.039)	-.025 (.038)	.837 (.594)	-.013 (.056)	-.041 (.053)	.343 (.784)
Security firms	-.044 (.036)	-.145*** (.035)	.423 (.540)	-.054 (.049)	-.136*** (.046)	-.175 (.656)
Independent Forecasters	-.158*** (.044)	-.262*** (.043)	1.653** (.653)	-.240*** (.062)	-.350*** (.059)	2.618*** (.824)
Corporate forecasters	-.033 (.083)	-.090 (.080)	1.874 (1.214)	na	Na	na
Econometric models	-.047 (.064)	-.107 (.062)	-1.483 (.974)	.014 (.077)	-.062 (.074)	-2.552** (1.113)
Constant	.047 (.031)	.108 (.030)	-.582 (-1.28)	.015 (.041)	.069 (.039)	-.454 (.529)
F test for differences across employers[2]	3.46***	10.91***	2.93**	4.95***	10.58***	5.92***

, * represent statistical significance at the .05 and .01 levels

[1] This F statistic tests that the coefficients for all individuals are the same.

[2] This F statistic tests that the coefficients for all employer types are the same.

[3] Panel 1 includes all economists having at least 6 forecasts.

[4] Panel 2 includes all economists having at least 20 forecasts.

Table 7
OLS Estimates of Incentives Model

Dependent variable: Absolute value of the deviation of an economist's time t forecast from the time t forecast mean excluding that economist

Data set	Panel 1			Panel 2		
Number of forecasters	93	93	79	33	33	33
Number of forecasts	1650	1650	1280	924	924	722
Forecast variable	T-Bill	T-Bond	Yen/$	T-Bill	T-Bond	Yen/$
AGE	-.0018*	-.0021**	-.0428***	-.0022	-.0029**	-.0435**
	(.0011)	(.0010)	(.0149)	(.0015)	(.0014)	(.0206)
AGE*MODEL	.0002	-.0041	.0214	.0040	-.0011	-.0165
	(.0045)	(.0042)	(.0720)	(.0054)	(.0049)	(.0956)
AVEDEV	.8436***	.6983***	.8610***	1.0475***	.9218***	.6490***
	(.0512)	(.0765)	(.0793)	(.0830)	(.1148)	(.1108)
OWN	.1697***	.1298***	1.7425***	.2185***	.2042***	1.6198**
	(.0382)	(.0364)	(.5638)	(.0514)	(.0470)	(.6782)
Independent but not OWN	.0527	.0710**	.2293	.0370	.1095**	.1236
	(.0333)	(.0318)	(.4760)	(.0505)	(.0462)	(.6422)
Banks	-.0742***	-.0944***	-.9469***	-.1388***	-.1574***	-1.9637***
	(.0269)	(.0257)	(.3983)	(.0396)	(.0362)	(.5339)
Securities firms	-.0254	.0115	-.3453	-.0844**	-.0495	-1.7803***
	(.0248)	(.0236)	(.3616)	(.0344)	(.0316)	(.4485)
Corporate forecasters	-.1133**	-.0966*	-.7845			
	(.0572)	(.0539)	(.8384)			
Econometric Models	-.1476**	-.0974	-1.1935	-.2706***	-.2020**	-1.1726
	(.0334)	(.0698)	(1.3083)	(.0962)	(.0875)	(1.9129)
Constant	.0979***	.1492***	1.5665***	.0836*	.1319**	3.4837***
	(.0334)	(.0397)	(.5343)	(.0502)	(.0573)	(.7448)
F test for differences across industries	9.20***	10.53***	4.40***	11.82***	14.38***	8.51***
R^2	.185	.097	.101	.218	.150	.100
*, **, and *** represent statistical significance at the .10, .05, and .01 levels						

FEDERAL RESERVE BANK OF ST. LOUIS

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Predicting Interest Rates: A Comparison of Professional and Market-Based Forecasts

Michael T. Belongia

Interest rates have varied substantially in recent years. Since 1981, for example, the monthly average three-month Treasury bill rate has ranged between 5.18 percent and 16.30 percent while the Baa corporate bond rate ranged between 9.61 percent and 17.18 percent; the prime rate during this time reached a high of 20.5 percent and fell to a low of 7.5 percent. Interest rate movements are important, of course, because they affect the present value of streams of future payments, that is, wealth. Moreover, the risk of interest rate changes is related directly to the level of interest rates.[1] During the 1980s, therefore, firms and individuals have faced substantial exposure to interest rate risk.

There are at least two approaches that can be taken to reduce the magnitude of this problem. The first is to hedge interest rate risk, which has been discussed at length in this *Review* and elsewhere.[2] The second is to forecast the likely course of interest rates. This article investigates the reliability of such forecasts in general and assesses the specific usefulness of forecasts by professional economists.

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[1]Interest rate risk, for a firm whose portfolio is composed of streams of future receipts and payments, is measured by the interest elasticity of the portfolio; for a single asset, this can be expressed as $-n(i/1+i)$, where n is the term to maturity. A more general expression for a portfolio of assets and liabilities is derived in Belongia and Santoni (1987). In either case, the level of interest rate risk rises with the interest rate.

[2]See Belongia and Santoni (1984, 1985).

INTEREST RATE FORECASTS: THEORY AND EVIDENCE

Given the popular attention that such forecasts command, it is surprising to note what economic theory says about them: they are unlikely to provide accurate insights about the future. This argument is stated clearly by Zarnowitz:

> It might be argued that these are *forecasts* of people who study the economy (experts), which are quite unlike the *expectations* of those who act in the economy (agents). On the one hand, the experts are usually credited with more knowledge of the economy at large than the agents have. On the other hand, the experts are often charged with being less strongly motivated to predict optimally than the agents who are seen as having more at stake. [3]

Economists, at least on one level, lack sufficient incentives to make forecasts that are more accurate than information already available in the marketplace. Moreover, previous studies have shown there is little systematic difference among professional forecasts, at least partly because they "use to a large extent the same data, receive the same news, interact, and draw upon a common pool of knowledge and techniques."[4]

The key issue, however, really is not whether experts have more (or better) information than the public, but whether individuals who consistently can fore-

[3]See Zarnowitz (1983), p. 2.

[4]See Zarnowitz (1986), p. 6, and the references cited therein.

cast interest rates more accurately than the market are likely to make their forecasts public. The reason has to do with individual self-interest. Quite simply, why would anyone reveal valuable insight about the future when he could increase his wealth directly by appropriately trading in financial markets using this information?

If, for example, a person *knew* that the three-month Treasury bill rate would be 6.50 percent in December, while the futures market currently priced it at 7.00 percent, the forecaster's wealth gain would be limited only by his ability to buy December Treasury bill futures; in this example, he would make a profit of $1,250 on every contract he could buy.[5] Certainly, he has no incentive to make the same forecast public without appropriate compensation, at least until he had taken as large a position in the market as he could. Of course, forecasters may have incentives to sell forecasts that are of no value to their wealth; it is not clear, however, why other individuals would pay for such predictions.

As a general rule, the accuracy of economic forecasts varies widely across variables. Previous research has found that predictions of the three-month Treasury bill rate six months into the future by major commercial forecasters are within two percentage points of the actual rate only 67 percent of the time.[6] Thus, if in June, the three-month Treasury bill rate was forecast to be 7 percent in December, there is only a 0.67 probability that the actual December rate would be somewhere between 5 percent and 9 percent. Other studies have shown that error statistics often double in size when the forecast horizon is extended as little as from one to two quarters ahead.[7]

The Efficient Markets Hypothesis and Interest Rate Forecasts

A model of interest rate determination demonstrates why individuals are unable (as opposed to unwilling) to forecast interest rates more accurately, on average, than the forecasts already implied by current spot rates or prices in the interest rate futures markets. This model, known as the efficient markets model, states that the *expected* interest rate at some specified future point in time, given all information presently available, is equal to the current interest rate plus whatever change in the interest rate is suggested by currently available information.[8]

The driving force behind the efficient markets model is the information available to traders in the market and the incentives they have to use this information. Current market rates and expectations of future rates are influenced by changes in information that affect expectations about the future. Because new information is unknown until it actually is released, success in predicting future interest rates depends upon predicting both future changes in the information *and* the market's reaction to such "news."

An Illustration of the Efficient Markets Model

One illustration of the efficient markets model applied to actual data is the change in interest rates that follows the weekly Federal Reserve M1 announcement that usually occurs at 4:30 p.m. [EST] each Thursday. The assumption is that the interest rate at 3:30 p.m., just prior to the announcement, fully reflects all currently available information relevant to the Treasury bill rate, including various forecasts of the Fed's yet-to-be-announced change in M1; thus, the available information at 3:30 p.m. includes both actual and predicted data.

When the Fed announces the M1 change at 4:30 p.m., the market's information set is revised with the actual M1 change replacing its predicted value. If no other significant information is released until rates are observed again at 5 p.m., the change in the Treasury bill rate from 3:30 to 5 p.m. reflects the market's reaction to the news in the M1 announcement. If the actual and predicted M1 values are different, the efficient markets model predicts that interest rates will react to the new information in the Fed's M1 announcement; many studies have found this result empirically.[9]

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[5]Treasury bill futures are priced by subtracting the Treasury bill interest rate from 100. Thus, interest rates of 7.00 and 6.50 percent imply contract prices of 93.00 and 93.50, respectively. Moreover, each basis-point change in the interest rate is worth $25 on the value of a contract. Buying one contract at 93.00 and selling at 93.50 would show a simple profit of 50 basis points × $25 = $1,250, abstracting from commission and other costs.

[6]McNees, p. 11.

[7]Typically, the criterion is root-mean-squared error (RMSE); see McNees (1986). Also, see Zarnowitz (1983).

[8]The efficient markets model applied to interest rate determination can be expressed as:

$$E(i_{t+1}|\Omega_t) = i_t(1 + E(i_{t+1} - i_t|\Omega_t)),$$

where E is the expectations operator and Ω_t is the information available to agents at the time forecasts are made. For more detail on this model, see Fama and Miller (1972) or Mishkin (1983).

[9]See Sheehan (1985) and Belongia and Sheehan (1987) for a survey and critique of these studies.

This example demonstrates the major point of the efficient markets model: changes in interest rates depend on changes in information. A forecast that interest rates will be higher six months from now than what already is implied by the underlying term structure really is a forecast that new information will be revealed which will cause market participants to raise the rate of interest. Such forecasts are potentially useful only if the forecasters consistently have better information, on average, than the other market participants generally possess. Or, to state the proposition differently, a useful forecast is not simply an accurate one; it also must tell something about the future that is not already reflected in current market interest rates.

A COMPARISON OF INTEREST RATE FORECASTS

A comparison of alternative interest rate forecasts is essentially a comparison of information sets that forecasters possess. The futures market, as well as forecasts that simply assume the future will resemble the present, provide useful alternatives to forecasts produced by specialized forecasting services. If all forecasts have similar accuracy, it would suggest that market participants use essentially the same information.

Survey Forecasts

The information content of economists' forecasts is intriguing for a variety of reasons. Presumably, their specialized training gives them insight to the workings of financial markets. In return for their services, the economists involved earn relatively large salaries; moreover, some command considerable public attention. The latter group should include those whose forecasts are among the best of competing alternatives.

Market Forecasts

The futures market offers an interesting perspective on forecasts. At a given point in time, individuals may enter into agreements to buy or sell interest-sensitive assets, such as Treasury bills, at a date as much as two years into the future. The collective actions of investors betting that interest rates will rise from today's level (who will sell Treasury bill futures short) and investors betting that interest rates will fall (who will buy, or go long in, Treasury bill futures) determine, at each moment in time, the "market's" expectation of what interest rates will be at a specified future date. Such forecasts are interesting for two reasons: they reflect all available information held by market participants and these participants have a compelling reason to forecast accurately. If they are wrong, the money lost is their own!

A naive or no-change model is an interesting third alternative because, as previously noted, predicting interest rates really involves predicting changes in information and the market's reaction to this news. If one believes it is impossible to predict actions by OPEC, changes in macroeconomic policy, revisions in economic data and other factors that affect expectations of future interest rates, the best strategy would be to predict no change in information and, hence, no change in interest rates. Certainly, as the length of the forecast horizon grows shorter, the probability of large changes in information (and interest rates) declines as well.

Sources of Forecasts: Professional and Market Data

The six-month-ahead forecasts of the three-month Treasury bill rate by nine economists surveyed regularly by the *Wall Street Journal* were collected over the period December 1981 through June 1986. These forecasts, which are published on or about each January 1 and July 1, yielded 10 forecast periods and 90 predictions to be evaluated. Each forecast was assumed to be made the day before publication.[10]

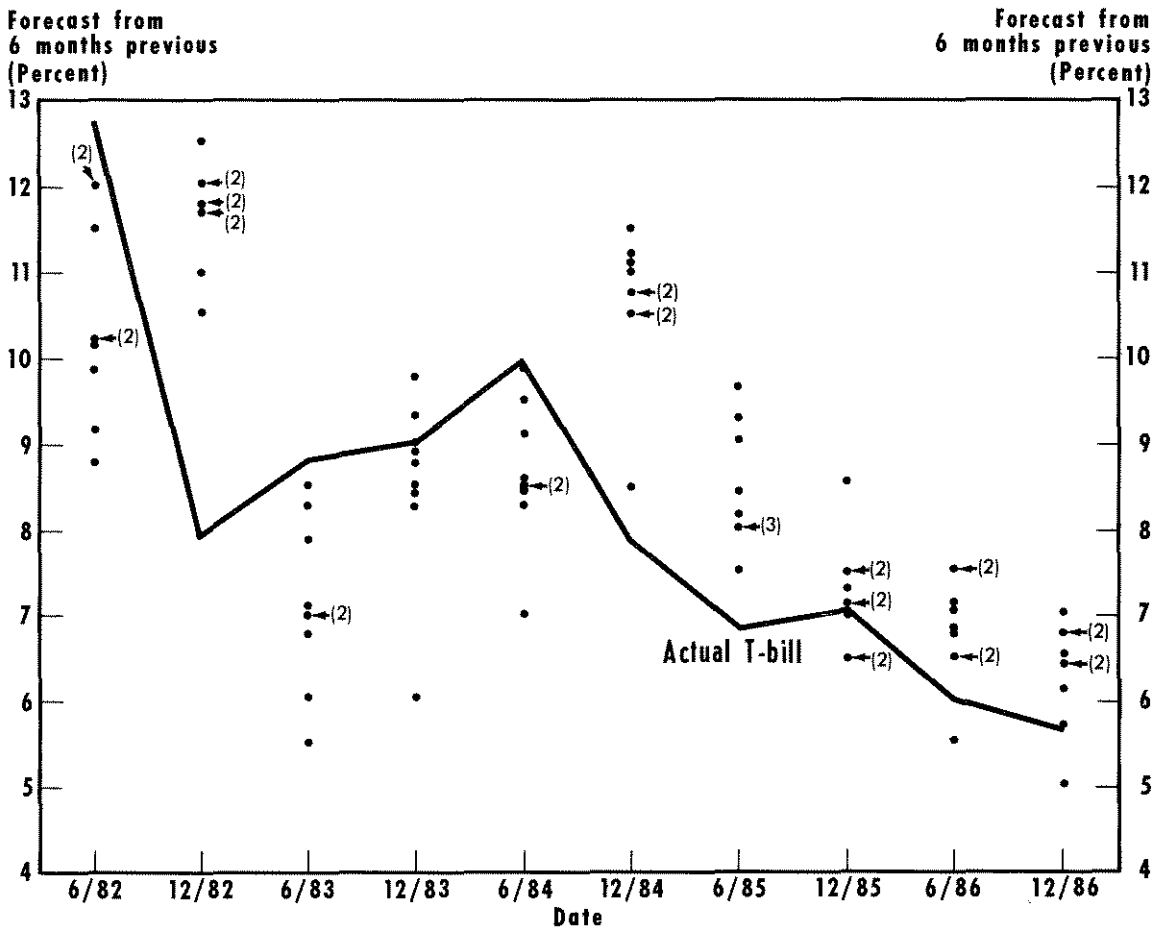
Comparable forecasts from the futures market were derived by observing on June 30 the three-month Treasury bill rate implied by the December Treasury bill futures contract and on December 31 the rate implied by the June contract. A larger sample to be used later also employed observations on the March futures contract from the previous September 30 and on the September contract from March 31. These data were compared with actual Treasury bill rates on the day the relevant futures contract ceased trading.[11] The procedure yielded 40 observations, of which 10 coincided with dates of the economists' forecasts. The naive or no-change forecast was obtained by observing the spot Treasury bill rates on the last business days of March, June, September and December and predicting that same rate would exist on the last day of the month six months hence. Again there are 40 observa-

[10]The full *Wall Street Journal* survey includes many more economists, but only nine individuals have responded consistently since the initial survey in December 1981.

[11]Treasury bill futures contracts usually are liquidated in the third week of their terminal months, not the last day of the month as with the economist forecasts.

Chart 1

Treasury Bill Rates: Actual and Predicted



tions over the 1977–86 interval with 10 coinciding with dates of the economist survey. Although this sample of market-based forecasts includes only 10 observations that coincide with the economists' forecasts, it serves as the basis for the first comparison. Subsequent analysis uses the entire sample back to 1977 for a stronger test of forecast accuracy.

Forecasts of Direction of Change

A first assessment about the accuracy of the professional forecasts was made against a relatively weak criterion, the predicted *direction* of change. That is, if rates were forecast to increase (or decrease), did they? The individual forecasts relative to subsequent actual values are plotted in chart 1.

The 90 individual expert predictions correctly forecast the *direction* of change on 38 occasions, or 42 percent of the time. If interest rate movements are random, a 50 percent record of accuracy would be expected.[12] Only one of the nine forecasters guessed

[12]This type of performance — the strategies of professional investors yielding returns inferior to those of simple rules — is common. For example, the mean equity fund managed by professional institutional money managers rose 16.7 percent in 1986 compared with an 18.7 percent rise in the S&P 500 index. Moreover, more than 67 percent of the money managers produced returns in 1986 smaller than the general increase in market values, as measured by the S&P 500; see Wallace (1987). For a more extensive discussion of this result and a similar finding of inferior performance by mutual fund managers over time, see Malkiel (1985), pp. 147–82, and the references to his chapter 7.

Table 1
Summary Statistics for Errors from Alternative Forecasts: June 1982-December 1986

	MAE	Mean error	RMSE	n
Economist individual forecasts	1.625	–0.406	2.056	90
Economist mean forecast	1.550	–0.406	1.889	10
Futures market forecast	1.466	–1.132	2.253	10
Naive forecast	1.321	–0.543	1.859	10

the direction of change correctly more than one-half of the time; he was correct on six of 10 occasions. Three others guessed the correct direction of change on five of 10 occasions. The worst individual performance was two correct predictions.

For the 40 quarterly predictions derived from futures market observations, 22, or nearly 55 percent, correctly forecast the direction of change. Over the shorter 1982–86 sample, five of 10 directions of change were predicted correctly by the futures market. On the simple criterion of direction of change, the futures market outperforms the economists surveyed.[13]

Point Forecasts

A different criterion by which to evaluate forecasts is a comparison of the point estimates of the predicted changes in interest rates with the actual changes. These comparisons were analyzed several ways. First, forecasts by the nine experts provided 90 individual predictions of the Treasury bill rate. These individual predictions also could be aggregated to form a consensus, or average, prediction for the nine economists at a specific moment in time. The performance of the experts relative to the futures market and naive forecasts first was judged over the short 1982–86 sample that coincided with the economist survey. Differences between actual Treasury bill rates and, respectively, the economist, futures market and naive forecasts were calculated to generate values for forecast errors. All errors were calculated as actual minus predicted values. Table 1 shows the summary statistics for these errors.

The entries in table 1 represent the mean absolute error (MAE), mean error and root-mean-squared error (RMSE) from forecasts for the three-month Treasury bill rate six months into the future. The first two rows are associated with the individual and consensus forecasts from the survey of experts. The third row is based on the differences between the actual Treasury bill rate and the futures market prediction. The fourth row is based on the naive predictions, the differences between current and previous actual rates.

The most interesting aspect of these summary statistics is their remarkable similarity. Of course, this result was predicted by the earlier theoretical discussion, which emphasized that all available information would be reflected in current market rates. The mean errors for all forecasts are negative, indicating that these methods tended to overestimate the interest rate; the futures market, however, tended to be the most bearish forecaster on this account by overpredicting the Treasury bill rate an average of 1.132 percentage points. MAE statistics also are similar, with a range of about 30 basis points between the best (naive) and worst (individual economist). The RMSE statistic, which is a measure of the dispersion of forecast errors, shows the naive and economist consensus to perform best.[14]

[13]There is no meaningful way to construct a direction-of-change criterion for the naive forecast.

[14]The likely explanation for the futures prediction having the highest RMSE is the method of calculation. The RMSE will tend to be lower for forecasts that made many errors of a similar size relative to forecasts that had smaller errors, on average, but had several very large errors. This result occurs, of course, because calculating the RMSE involves squaring the forecast errors. The effects of random variation in small samples also is a potential source of distortion. Thus, two very large futures market errors offset a record of generally accurate forecasts as indicated by other statistics.

Table 2
Market-Based Forecasts Over a Longer Horizon: March 31, 1977 - December 31, 1986

	MAE	Mean Error	RMSE	n
Futures market forecast				
Daily data	1.676	–0.163	2.589	40
Weekly averages	1.702	–0.141	2.634	40
Naive forecast				
Daily data	1.740	0.035	2.578	40
Weekly averages	1.788	0.027	2.695	40

Longer Sample Results for Market-Based Forecasts

Error statistics from the longer 10-year sample of quarterly observations described earlier are reported in table 2. Because daily interest rate changes are volatile and a large, one-day change could affect the results, forecasts for a specific date also were compared with the average Treasury bill rate for the week in which that date occurred.

Relative to the previous results, the futures market average errors declined substantially to near 15 basis points, compared with the shorter sample mean error of about 113 basis points. MAE and RMSE values increased slightly, however, for the longer sample. The forecast errors do not appear to vary with the use of daily or weekly average values for the terminal period spot rate. The naive forecast also shows slight increases in MAE and RMSE values but its mean error falls about 50 basis points to near zero. Again, while these statistics are not directly comparable with the economist forecasts because of the different sample periods, nothing in them suggests superior performance by the economists.

Market Reaction to Forecasts

As a final check on the information content of the expert forecasts, daily Treasury bill rates were divided into two groups: those for days when the experts' forecasts were published and those for other trading days. (Recall that the forecasts are useful to the market only if they add to the existing pool of market information.) To test whether this is true, equation (1) was estimated:

$$(1)\quad TB_t = \underset{(1.02)}{0.015} + \underset{(657.2)}{0.998}\, TB_{t-1} + \underset{(0.95)}{0.049}\, ANNOUNCEMENT + e_t,$$

$$\bar{R}^2 = 0.99 \qquad DW = 1.77$$

where the daily value of the Treasury bill rate (TB_t) is regressed on the previous day's value (TB_{t-1}) and a dummy variable (ANNOUNCEMENT) that takes a value of one on the 11 days that the expert forecasts were released.[15] If the expert forecasts add to the market's information, the coefficient for the ANNOUNCEMENT variable should be significantly different from zero; as the t-statistic of 0.95 reveals, however, we cannot reject the hypothesis that the forecast announcements have no effect on Treasury bill rates. Apparently, the Treasury bill market had already incorporated the information underlying these forecasts prior to their public release.

SUMMARY

Interest rate risk has been substantial in the 1980s, and, by no coincidence, the demand for interest rate forecasts has increased. There are strong theoretical reasons to believe, however, that such forecasts are subject to large errors. Moreover, anyone who could predict interest rates more accurately, on average, than other market participants would have no reason to make his forecasts publicly. Comparisons of interest rate forecast errors support the notion that several market-based forecasts, using information easily accessible to the general public, predict the Treasury bill rate six months into the future as well as a panel of prominent forecasters.

Why, then, do economists make public forecasts of interest rates and seemingly earn large salaries for doing so? Several explanations related to other primary functions of corporate economists seem plausible. First, economists may serve an advertising function for their firms: they are paid, in part, to get the

[15]It is possible to use the January 3, 1987, survey for this estimation.

firm's name mentioned in the press often, and forecasting interest rates is one way to achieve this end. Second, economists may provide a managerial insurance function. If a business decision has the potential to cause large losses, managers who have relied on the input of economists cannot be held negligent, in the sense of acting without seeking "the best information available at the time." Finally, forecasting interest rates may be a trivial portion of an economist's overall function; his compensation may be based primarily on analytical performance in other areas. It is unlikely, however, that economists are employed primarily for their ability to predict interest rates more accurately than the market.

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FORTUNE

9% Forever?

That's economist Roger Ibbotson's forecast for stock market returns. HE'S BEEN RIGHT--very right--in the past. So how come some people think we shouldn't believe him anymore?

By JUSTIN FOX
December 26, 2005

(FORTUNE Magazine) – In May 1974, in the depths of the worst bear market since the 1930s, two young men at a University of Chicago conference made a brash prediction: The Dow Jones industrial average, floundering in the 800s at the time, would hit 9,218 at the end of 1998 and get to 10,000 by November 1999.

You probably have a good idea how things turned out: At the end of 1998, the Dow was at 9,181, just 37 points off the forecast. It hit 10,000 in March 1999, seven months early. Those two young men in Chicago in 1974 had made one of the most spectacular market calls in history.

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What became of them after that? One, Rex Sinquefield, went on to found a mutual fund company that now manages more than $80 billion. The other, Roger Ibbotson, kept making market forecasts, forecasts of long-run stock and bond returns that have become deeply woven into the fabric of American life. Simply put, if you believe that stocks are fated to return 10% on average over the long haul, Ibbotson is probably the reason why.

It's hard to overestimate the influence of those numbers. The forecasts and historical return data churned out by Ibbotson Associates transformed the pension fund business in the late 1970s and 1980s, leading managers to make an epic shift out of bonds and into stocks. They formed the inescapable backdrop to the 1990s personal investing boom, as brokers, financial planners, and journalists endlessly repeated the Ibbotson mantra of double-digit stock market returns as far as the eye could see. Lately the Ibbotson forecasts have been finding their way into 401(k)s, as Ibbotson and other firms using similar methods build portfolios for those who opt not to build their own. Ibbotson even sells hundreds of thousands of charts each year showing how stocks build wealth over time--and beat the crap out of bonds.

All this means it's of more than academic interest that an academic debate has been raging for years now over the theories upon which Ibbotson and Sinquefield based their forecast in 1974, and which Ibbotson has followed since. Ibbotson, now 62, has taken some of the criticism to heart, and in the process ratcheted down his long-run forecast for stock returns from more than 10% a year to 9.27%. That alone was something of a shock for many of his clients, Ibbotson says. But a few critics think the real number may turn out to be just 5% or 6%. In that case stocks would barely outperform government bonds--an eventuality that would entirely rearrange the investing world yet again.

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The most important thing to understand about the forecast that Roger Ibbotson and Rex Sinquefield churned out in 1974 is that it wasn't an attempt to outsmart or outguess the market as Wall Street seers had traditionally done. Instead, Ibbotson and Sinquefield were simply trying to use the information already embedded in stock prices to, as they put it, "uncover the market's 'consensus' forecast." Their tools were a half-century of historical data and the bold new philosophy of stock market behavior that they had internalized as students at the University of Chicago's Graduate School of Business.

They did it at a time when theories batted about in Chicago classrooms really were changing the world, or were about to. In the early 1970s, Ibbotson says, "everything was going on at the University of Chicago." The professors on his Ph.D. dissertation committee included two future Nobel Prize winners (Merton Miller and Myron Scholes), another who would have won if he hadn't died before the Nobel committee got to him (Fischer Black), yet another whom many colleagues think should win the Nobel (Eugene Fama), and a father of Reagan-era supply-side economics (Arthur Laffer).

Not counting the Black-Scholes options-pricing formula and the Laffer curve, which don't have major roles in this drama, the biggest ideas at the Chicago Business School in the early 1970s were the efficient-market hypothesis and the capital asset pricing model. The gist of the efficient-market idea, as articulated in the 1960s by Eugene Fama, is that today's price is the best possible measure of a stock's value, and that nobody can reliably predict which way prices will be headed tomorrow. The capital asset model says that you nonetheless can predict long-run stock returns because they are a reward for taking risks, and those risks can be measured. While CAPM, as it is known, was devised elsewhere, Chicago's Fischer Black was among its most fervent adherents.

Ibbotson arrived on campus in 1968. He was a kid from the Chicago suburbs who studied math and physics at Purdue and got an MBA at Indiana University. After struggling in the workforce, he went to Chicago to earn a Ph.D. in finance and hit his stride. While still a student, he got a job managing the university's bond portfolio. Meanwhile his friend Sinquefield, a 1972 MBA working at a Chicago bank, was launching one of the first S&P 500 index funds for institutional investors (this when Vanguard was still but a gleam in Jack Bogle's eye). Chicago really was a heady place for young finance geeks in those days.

Ibbotson and Sinquefield both needed up-to-date historical data on security prices for their work, and both knew that the professors who ran the Chicago business school's Center for Research in Security Prices (CRSP) were in no hurry to repeat the epic number-crunching exercise they had undertaken in the early 1960s to build a database of stock prices going back to 1925. So the two men took on the job of updating the CRSP (pronounced "crisp") stock database and assembling a similar price history for bonds and Treasury bills.

They presented their preliminary findings in May 1974 at one of the twice-yearly seminars that CRSP hosted to share the latest academic research with bankers, mutual fund managers, and the like. "Just getting the data was a coup," Ibbotson says. Then there was the forecast, suggested to them by Fischer Black. Black thought of using the data to calculate the additional return that investors had historically received for investing in risky stocks rather than in relatively safe government bonds. According to CAPM theory, this "risk premium" reflects something real and durable about the rewards investors demand for taking the chance of losing money. Real and durable enough, it seemed in 1974, to build a stock market prediction on.

Once Ibbotson and Sinquefield figured out the historical risk premium, all they had to do was add it to the prevailing risk-free interest rate (Treasury bonds or bills, depending on one's planning horizon) to get the "consensus" forecast of market returns. Actually they made it a little more complicated than that: When they finally published their work in 1976, they presented their forecast as the middle point of a wide range of different possible results. The mean forecast for the 25 years through 2000 was for 13% annual stock market returns, with 95% confidence that the return would be between 5.2% and 21.5%. (The actual return was 15%.)

"In some ways it was the first scientific forecast of the market," Ibbotson says proudly. Not everyone saw it that way at the time; some skeptics complained it was just a gussied-up extrapolation of the past into the future. But there turned out to be a ravenous hunger for such data. Both researchers were swamped with requests for more information and advice. For a while Ibbotson, by this time a very junior professor of finance at Chicago, just let the letters pile up unopened in a drawer in his office. In 1977 he decided to make a business out of his research project and started Ibbotson Associates. He also kept teaching at Chicago--until 1984, when his wife, health economist Jody Sindelar, got a job at Yale and he wangled an appointment there as a finance professor. Since then he's left the day-to-day management of the company, still based in Chicago, in the hands of others, while he remains its public face and chief researcher. Sinquefield, meanwhile, launched small-cap index fund manager Dimensional Fund Advisors with another Chicago finance graduate, David Booth, in 1981.

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While Ibbotson Associates grew and prospered in the 1980s and 1990s, however, the theories upon which its forecasts are based began to crumble in the face of contradictory evidence. The initial onslaught came from skeptics of the efficient-market hypothesis like Ibbotson's Yale colleague Robert Shiller, who argued that investor mood swings drove stock prices too high or too low for years on end. The experience of the late 1990s confirmed to many that there was something to this. But Ibbotson says he can't base his forecasts on such arguments. "It's not that I believe markets are so efficient," Ibbotson says. "It's just that I don't want to use a mispricing to make predictions." He's trying to divine a middle-of-the-road consensus, not trot out a CNBC-style market call. Fair enough.

A harder-to-dismiss critique came from Mr. Efficient Markets himself, Ibbotson's dissertation advisor Eugene Fama. In a series of papers written with Dartmouth's Kenneth French, Fama has argued that the capital asset pricing model, or at least its 1970s corollary that the risk premium is constant, doesn't match the facts. "My own view is that the risk premium has gone down over time basically because we've convinced people that it's there," Fama says. Ibbotson's stock market forecasting model is thus a victim of its own success.

Ibbotson agrees that Fama has a point, and that he can no longer bank on the historical equity premium to predict future returns. The alternative he has come up with is an estimate based on fundamentals. He takes the 10.31% annual return on stocks from 1925 through the present and strips out the tripling of the market's price/earnings ratio that's occurred since then. "We think of that as a windfall that you shouldn't get again," he says. The drivers of stock returns that remain are dividends, earnings growth, and inflation. Make a forecast of future inflation using current bond yields, assume that dividend and earnings growth history will repeat themselves, and you get a long-run equity-return forecast of 9.27%. When Ibbotson and his company's director of research, Peng Chen, first ran the numbers in 2001, the gap between the new forecast and the one using the equity premium method was more than a percentage point. Because P/Es have dropped since then, the gap has

shrunk. But Ibbotson's revised forecasting method doesn't insulate him from criticism any more than the old way. In fact, it invites new criticism.

The most persistent challenger has been Rob Arnott, a Pasadena money manager and editor of the Financial Analysts Journal, who thinks future equity returns could be below 6%. (See "Dueling Market Forecasts" chart.) The big difference between his forecast and Ibbotson's is that Arnott uses the current dividend yield (1.76%) as a starting point, while Ibbotson goes with the much higher long-term average yield (4.23%). Ibbotson believes the historical number provides a better picture of what investors think is ahead. He still relies on the assumption that markets are efficient, so current dividend yields must be low for a reason--his guess is that investors are expecting big growth in earnings (and dividends) in the future. Arnott, whose research has shown that low yields in the past were followed by slow earnings growth, thinks that's balderdash. "One of my biggest beefs with the academic community is the notion that theory is fact," he complains. "When they find evidence that contradicts the theory, instead of saying, 'Wonderful, let's improve the theory,' they throw it out because it conflicts with theory."

But the theoretical assumption that the market knows best is central to Ibbotson's whole forecasting endeavor, something even Arnott acknowledges. "In a sense Ibbotson is trying to infer what the consensus view is," Arnott says. "I'm trying to profit from that consensus." What Ibbotson is telling us is that the market still believes stocks will handily outperform bonds over the long haul. And if the market turns out to be wrong about that, it won't just be Roger Ibbotson who feels the pain.

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UTILITY STOCKS AND THE SIZE EFFECT: AN EMPIRICAL ANALYSIS

Annie Wong*

I. Introduction

The objective of this study is to examine whether the firm size effect exists in the public utility industry. Public utilities are regulated by federal, municipal, and state authorities. Every state has a public service commission with board and varying powers. Often their task is to estimate a fair rate of return to a utility's stockholders in order to determine the rates charged by the utility. The legal principles underlying rate regulation are that "the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks," and that the return to a utility should be sufficient to "attract capital and maintain credit worthiness." However, difficulties arise from the ambiguous interpretation of the legal definition of *fair and reasonable rate of return* to an equity owner.

Some finance researchers have suggested that the Capital Asset Pricing Model (CAPM) should be used in rate regulation because the CAPM beta can serve as a risk measure, thus making risk comparisons possible. This approach is consistent with the spirit of a Supreme Court ruling that equity owners sharing similar level of risk should be compensated by similar rate of return.

The empirical studies of Banz (1981) and Reinganum (1981) showed that small firms tend to earn higher returns than large firms after adjusting for beta. This phenomenon leads to the proposition that firm size is a proxy for omitted risk factors in determining stock returns. Barry and Brown (1984) and Brauer (1986) suggested that the omitted risk factor could be the differential information environment between small and large firms. Their argument is based on the fact that investors often have less publicly available information to assess the future cash flows of small firms than that of large firms. Therefore, an additional risk premium should be included to determine the appropriate rate of return to shareholders of small firms.

The samples used in prior studies are dominated by industrial firms, no one has examined the size effect in public utilities. The objective of this study is to extend the empirical findings of the existing studies by investigating whether the size effect is also present in the utility industry. The findings of this study have important implications for investors, public utility firms, and state regulatory agencies. If the size effect does exist in the utility industry, this would suggest that the size factor should be considered when the CAPM is being used to determine the fair rate of return for public utilities in regulatory proceedings.

II. Information Environment of Public Utilities

In general, utilities differ from industriales in that utilities are heavily regulated and they follow similar accounting procedures. A public utility's financial reporting is mainly regulated by the Securities and Exchange Commission (SEC) and the Federal Energy Regulatory Commission (FERC). Under the Public Utility Holding Company Act of 1935, the SEC is empowered to regulate the holding company systems of electric and gas utilities. The Act requires registration of public utility holding companies with the SEC. Only under strict conditions would the purchase, sale or issuance of securities by these holding companies be permitted. The purpose of the Act is to keep the SEC and investors informed of the financial conditions of these firms. Moreover, the FERC is in charge of the interstate operations of electric and gas companies. It requires utilities to follow the accounting procedures set forth in its Uniform Systems of Accounts. In particular, electric and gas utilities must request their Certified Public Accountants to certify that certain schedules in the financial reports are in conformity with the Commission's accounting requirements. These detailed reports are submitted annually and are open to the public.

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The FERC requires public utilities to keep accurate records of revenues, operating costs, depreciation expenses, and investment in plant and equipment. Specific financial accounting standards for these purposes are also issued by the Financial Accounting Standards Board (FASB). Uniformity is required so that utilities are not subject to different accounting regulations in each of the states in which they operate. The ultimate objective is to achieve comparability in financial reporting so that factual matters are not hidden from the public view by accounting flexibility.

Other regulatory reports tend to provide additional financial information about utilities. For example, utilities are required to file the FERC Form No. 1 with the state commission. This form is designed for state commissions to collect financial and operational information about utilities, and serves as a source for statistical reports published by state commissions.

Unlike industriales, a utility's earnings are predetermined to a certain extent. Before allowed earnings requests are approved, a utility's performance is analyzed in depth by the state commission, interest groups, and other witnesses. This process leads to the disclosure of substantial amount of information.

III. Hypothesis and Objective

Due to the Act of 1935, the Uniform Systems of Accounts, the uniform disclosure requirements, and the predetermined earnings, all utilities are reasonably homogeneous with respect to the information available to the public. Barry and Brown (1984) and Brauer (1986) suggested that the difference of risk-adjusted returns between small and large firms is due to their differential information environment. Assuming that the differential information hypothesis is true, then uniformity of information availability among utility firms would suggest that the size effect should not be observed in the public utility industry. The objective of this paper is to provide a test of the size effect in public utilities.

IV. Methodology

1. Sample and Data

To test for the size effect, a sample of public utilities and a sample of industriales matched by equity value are formed so that their results can be compared. Companies in both samples are listed on the Center for Research in Security Prices (CRSP) Daily and Monthly Returns files. The utility sample includes 152 electric and gas companies. For each utility in the sample, two industrial firms with similar firm size (one is slightly larger and the other is slightly smaller than the utility) are selected. Thus, the industrial sample includes 304 non-regulated firms.

The size variable is defined as the natural logarithm of market value of equity at the beginning of each year. Both the equally-weighted and value-weighted CRSP indices are employed as proxies for the market returns. Daily, weekly and monthly returns are used. The Fama-MacBeth (1973) procedure is utilized to examine the relation between risk-adjusted returns and firm size.

2. Research Design

All utilities in the sample are ranked according to the equity size at the beginning of the year, and the distribution is broken down into deciles. Decile one contains the stocks with the lowest market values while decile ten contains those with the highest market values. These portfolios are denoted by MV_1, MV_2, ..., and MV_{10}, respectively.

The combinations of the ten portfolios are updated annually. In the year after a portfolio is formed, equally-weighted portfolio returns are computed by combining the returns of the component stocks within the portfolio. The betas for each portfolio at year t, $\hat{\beta}_{pt}$'s, are estimated by regressing the previous five years of portfolio returns on market returns:

$$\tilde{R}_{pt} = \alpha_p + \hat{\beta}_{pt}\tilde{R}_{mt} + \tilde{U}_{pt} \qquad (1)$$

where

R_{pt} = periodic return in year t on portfolio p

R_{mt} = periodic market return in year t

U_{pt} = disturbance term.

Banz (1981) applied both the ordinary and generalized least squares regressions to estimate β; and concluded that the results are essentially identical (p.8). Since adjusting for heteroscedasticity does not necessarily lead to more efficient estimators, the ordinary least squares procedures are used in this study to estimate β in equation (1).

The following cross-sectional regression is then run for the portfolios to estimate γ_{it}, i = 0, 1, and 2:

$$R_{pt} = \gamma_{0t} + \gamma_{1t}\hat{\beta}_{pt} + \gamma_{2t}\hat{S}_{pt} + U_{pt} \qquad (2)$$

where

$\hat{\beta}_{pt}$ = estimated beta for portfolio p at year t, t=1968, ..., 1987

$\hat{S}_{pt}$ = mean of the logarithm of firm size in portfolio p at the beginning of year t

U_{pt} = disturbance term.

Depending on whether daily, weekly or monthly returns are used, a portfolio's average return changes periodically while its beta and size only change once a year. The γ_1 and γ_2 coefficients are estimated over the following four subperiods: 1968-72, 1973-77, 1978-82 and 1983-1987. If portfolio betas can fully account for the differences in returns, one would expect the average coefficient for the beta variable to be positive and for the size variable to be zero. A t-statistic will be used to test the hypothesis. The coefficients of a matched sample are also examined so that the results between industrial and utility firms can be compared.

V. Analysis of Results

1. Equity Value of the Utility Portfolios

The mean equity values of the ten size-based utility portfolios are reported in Table 1. Panels A and B present the average firm size of these portfolios at the beginning and end of the test period, 1968-1987. The first interesting observation from Table 1 is that the difference in magnitude between the smallest and the largest market value utility portfolios is tremendous. In Panel A, the average size of MV_1 is about $31 million while that of MV_{10} is over $1.4 billion. In Panel B, that is twenty years later, they are $62 million and $5.2 billion, respectively. Another interesting finding is that there is a substantial increase in average firm size from MV_9 to MV_{10}. Since these two findings are consistent over the entire test period, the average portfolio market values for interim years are not reported. These results are similar to the empirical evidence provided by Reinganum (1981).

The utility sample in this study contains 152 firms whereas Reinganum's sample contains 535 firms that are mainly industrial companies. Two conclusions may be drawn from the results of the Reinganum study and this one. First, utilities and industriales are similar in the sense that their market values vary over a wide spectrum. Second, the fact that there is a huge jump in firm size from MV_9 to MV_{10} indicates that the distribution of firm size is positively skewed. To correct for the skewness problem, the natural logarithm of the mean equity value of each portfolio is calculated. This variable is then used in later regressions instead of the actual mean equity value.

2. Betas of the Utility and Industrial Samples

The betas based on monthly, weekly and daily returns are reported for the utility and industrial samples. For simplicity, they will be referred to as monthly, weekly, and daily betas. In all cases, five years of returns are used to estimate the systematic risk. The betas estimated over the 1963-67 time period are used to proxy for the betas in 1968, which is the beginning of the test period. By the same token, the betas obtained from the time period 1982-86 are used as proxies for the betas in 1987, which is the end of the test period.

The betas from using the equally-weighted and value-weighted indices are calculated in order to check whether the results are affected by the choice of market index. Since the results are similar, only those obtained from the equally-weighted index are reported and analyzed.

Table 2 reports the monthly, weekly and daily betas of the two samples at the beginning and end of the test period. Panel A shows the various betas of the industrial portfolios. Two conclusions may be drawn. First, in the 1960's, smaller market value portfolios tend to have relatively larger betas. This is consistent with the empirical findings by Banz (1981) and Reinganum (1981). Second, this trend seems to vanish in the 1980's, especially when weekly and daily returns are used.

The betas of the utility portfolios are presented in Panel B. The table shows that none of the utility betas are greater than 0.71. A comparison between Panels A and B reveals that utility portfolios are relatively less risky than industrial portfolios after controlling for firm size. The comparison also reveals that, unlike industrial stocks, betas of the utility portfolios are not related to the market values of equity.

The negative correlation between firm size and beta in the industrial sample may introduce a multicolinearity problem in estimating equation (2). Banz (p.11) had addressed this issue and concluded that the test results are not sensitive to the

multicolinearity problem. For the utility sample, this problem does not exist.

3. Tests on the Coefficients of Beta and Size

The beta and firm size are used to estimate γ_1 and γ_2 in equation (2). A t-statistic is used to test if the mean values of the gammas are significantly different from zero. The tests were performed for four 5-year periods which are reported in Table 3. The mean of the gammas and their t-statistic are presented in Panel A for the utilities and in Panel B for the industrial firms.

The empirical results for the utility sample are reported in Panel A of Table 3. When monthly returns are used, 60 regressions were run to obtain 60 pairs of gammas for each of the 5-year periods. When daily returns are used, over 1200 regressions were run for each period to obtain the gammas. The results are similar: in all of the time periods tested, none of the average coefficients for beta and size are significantly different from zero. When weekly returns are used, 260 pairs of gammas were obtained. The average coefficients for beta are not significant in any test period, and the average coefficients for size are not significant in three of the test periods. For the test period of 1978-82, the average coefficient for size is significantly negative at a 5% level.

The test results for the industrial sample are reported in Panel B of Table 3. When monthly returns are used, the average coefficient estimates for size and beta are significant and have the expected sign only in the 1983-87 test period. When weekly returns are used, only the size variable is significantly negative in the 1978-82 period. When daily returns are used, the coefficient estimates for betas and size are not significant at any conventional level.

According to the CAPM, beta is the sole determinant of stock returns. It is expected that the coefficient for beta is significantly positive. However, the empirical findings reported in this study and in Fama and French (1992) only provide weak support for beta in explaining stock returns. The empirical findings in this study also suggest that the size effect varies over time. It is not unusual to document the firm size effect at certain time periods but not at others. Banz (1981) found that the size effect is not stable over time with substantial differences in the magnitude of the coefficient of the size factor (p.9, Table 1). Brown, Kleidon and Marsh (1983) not only have shown that size effect is not constant over time but also have reported a reversal of the size anomaly for certain years.

The research design of this study allows us to keep the sample, test period, and methodology the same with the holding-period being the only variable. The size effect is documented for the industrial sample in one of the four test periods when monthly returns are used and in another when weekly returns are used. When daily returns are used, no size effect is observed. For the utility sample, the size effect is significant in only one test period when weekly returns are used. When monthly and daily returns are used, no size effect is found. Therefore, this study concludes that the size effect is not only time-period specific but also holding-period specific.

VI. Concluding Remarks

The fact that the two samples show different, though weak, results indicates that utility and industrial stocks do not share the same characteristics. First, given firm size, utility stocks are consistently less risky than industrial stocks. Second, industrial betas tend to decrease with firm size but utility betas do not. These findings may be attributed to the fact that all public utilities operate in an environment with regional monopolistic power and regulated financial structure. As a result, the business and financial risks are very similar among the utilities regardless of their sizes. Therefore, utility betas would not necessarily be expected to be related to firm size.

The objective of this study is to examine if the size effect exists in the utility industry. After controlling for equity values, there is some weak evidence that firm size is a missing factor from the CAPM for the industrial but not for the utility stocks. This implies that although the size phenomenon has been strongly documented for the industriales, the findings suggest that there is no need to adjust for the firm size in utility rate regulations.

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Table 1

Average Equity Size of the Utility Portfolios at the Beginning and End of the Test Period
(Dollar figures in millions)

	A: Beginning (1968)	B: End (1987)
MV_1	$31	$62
MV_2	$77	$177
MV_3	$113	$334
MV_4	$161	$475
MV_5	$220	$715
MV_6	$334	$957
MV_7	$437	$1,279
MV_8	$505	$1,805
MV_9	$791	$2,665
MV_{10}	$1,447	$5,399

Table 2

Betas of the Two Samples at the Beginning and End of the Test Period

	Monthly Betas		Weekly Betas		Daily Betas	
	1963-67	1982-86	1963-67	1982-86	1963-67	1982-86
Panel A: Industrial Firms						
MV_1	0.89	1.00	1.15	0.95	1.11	0.92
MV_2	0.94	0.87	1.07	1.01	1.14	1.01
MV_3	0.88	0.82	1.12	0.86	1.14	1.04
MV_4	0.69	0.74	1.00	0.83	1.03	0.86
MV_5	0.73	0.80	1.05	0.96	1.13	1.01
MV_6	0.66	0.82	1.03	1.01	1.05	1.04
MV_7	0.64	0.81	0.97	1.04	0.98	1.09
MV_8	0.62	0.75	0.97	1.11	1.00	1.20
MV_9	0.52	0.78	0.84	1.06	0.94	1.16
MV_{10}	0.43	0.65	0.78	1.01	0.86	1.22
Panel B: Public Utilities						
MV_1	0.30	0.37	0.31	0.43	0.30	0.40
MV_2	0.28	0.38	0.37	0.47	0.36	0.44
MV_3	0.22	0.42	0.33	0.42	0.31	0.49
MV_4	0.27	0.35	0.36	0.52	0.34	0.54
MV_5	0.25	0.45	0.37	0.61	0.35	0.62
MV_6	0.25	0.41	0.39	0.54	0.40	0.65
MV_7	0.20	0.35	0.34	0.54	0.37	0.63
MV_8	0.17	0.38	0.34	0.65	0.33	0.68
MV_9	0.19	0.34	0.35	0.60	0.34	0.71
MV_{10}	0.18	0.29	0.38	0.59	0.39	0.71

Table 3

Tests on the Mean Coefficients of Beta (γ_1) and Size (γ_2)

$$R_{pt} = \gamma_{ot} + \gamma_{1t}\hat{\beta}_{pt} + \gamma_{2t}\hat{S}_{pt} + U_{pt}$$

Returns Used:		Monthly (t-value)	Weekly (t-value)	Daily (t-value)
Panel A: Utility Sample				
1968-72	γ_1	-0.46% (-0.26)	-0.32% (-0.42)	-0.02% (-0.18)
	γ_2	-0.07% (-0.78)	-0.01% (-0.51)	-0.00% (-0.46)
1973-77	γ_1	-0.28% (-0.13)	0.14% (0.14)	-0.03% (-0.21)
	γ_2	-0.11% (-0.70)	-0.03% (-0.67)	-0.00% (-0.53)
1978-82	γ_1	0.55% (0.36)	0.54% (1.00)	0.05% (0.43)
	γ_2	-0.10% (-0.75)	-0.05% (-1.71)*	-0.01% (-1.60)
1983-87	γ_1	1.74% (1.28)	-0.24% (-0.51)	-0.02% (-0.18)
	γ_2	-0.16% (-1.54)	-0.03% (-0.86)	-0.01% (-0.63)
Panel B: Industrial Sample				
1968-72	γ_1	-0.36% (-0.27)	-0.28% (-0.55)	-0.02% (-0.32)
	γ_2	0.07% (0.43)	-0.01% (-0.19)	0.00% (0.51)
1973-77	γ_1	1.34% (0.64)	-0.23% (-0.31)	0.14% (1.45)
	γ_2	-0.01% (-0.06)	-0.04% (-0.85)	-0.00% (-0.64)
1978-82	γ_1	-0.84% (-0.28)	-0.56% (-0.91)	-0.09% (-0.81)
	γ_2	-0.29% (-0.75)	-0.01% (-1.72)*	-0.00% (-1.33)
1983-87	γ_1	2.51% (1.83)*	0.34% (0.64)	0.11% (1.40)
	γ_2	-0.25% (-1.90)*	-0.01% (-0.43)	0.00% (0.14)

* Significant at the 5% level based on a one-tailed test.

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The Absence of a Size Effect Relevant to the Cost of Equity

Clifford S. Ang

In this paper, I evaluate whether there is a size effect that is relevant to the cost of equity. I first analyze what model investors use to determine the required rate of return on their investment and find investors prefer the Capital Asset Pricing Model (CAPM) over other models, even those that include a size proxy. I also show that over the period 1981 to 2016, small stocks underperformed large stocks, which is inconsistent with the existence of a size effect. Finally, I conclude that size effect studies have not been able to surmount the criticisms that the size effect lacks a theoretical basis and that the results of size effect studies are susceptible to data mining criticisms. Given these results, practitioners should reconsider the standard practice of augmenting their cost of equity with a size premium.

Introduction

The cost of equity capital is a critical component when valuing a firm. It is used as the rate to discount equity cash flows, or it is a component of the weighted-average cost of capital used to discount firm cash flows. The Capital Asset Pricing Model (CAPM) is typically used when calculating the cost of equity. Standard finance textbooks warn against adding "arbitrary fudge factors" to the discount rate,[1] but practitioners often augment or modify their cost of equity with a size premium reported in publications by Morningstar/Ibbotson and Duff & Phelps.[2] The size premium is thought of as compensation for the outperformance by small stocks relative to large stocks on a risk-adjusted basis.[3] There are studies that document such outperformance,[4] but there are also studies that show the size effect does not exist, the size effect vanished in the 1980s, and the methods, inputs, and/or assumptions in the size effect studies are flawed.[5]

As it pertains to valuation, a potential source of confusion among the size effect studies is the conflating of the potential impact of size on expected cash flows with the potential impact of size on the cost of equity. In this paper, I attempt to clarify this confusion by investigating whether the size effect has an impact on the cost of equity. The results of my analyses suggest that there is an absence of a size effect that is relevant to the cost of equity. Consequently, practitioners may have to reconsider the standard practice of augmenting their cost of equity with a size premium. This also implies that any

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[1] Richard Brealey, Stewart Myers, and Franklin Allen, *Principles of Corporate Finance*. 10th ed. (New York: McGraw-Hill Irwin, 2011).

[2] Charles Jones, *Investments: Analysis and Management*. 11th ed. (New York: Wiley, 2009).

[3] This definition of a size premium is consistent with the definition in Banz (1981), the seminal paper on the size effect: Rolf Banz, "The Relationship Between Return and Market Value of Common Stocks," *Journal of Financial Economics* 9 (1981):3–18. However, some size effect studies advocate for a different measure of size, such as book value of assets, sales, and number of employees. See, for example, Roger Grabowski, "The Size Effect—It is Still Relevant," *Business Valuation Review* 35 (2016):62–71. However, other studies have shown that some of these alternative measures of size are not related to returns. See, for example, Jonathan Berk, *An Empirical Re-Examination of the Relation Between Firm Size and Return*. Working Paper (Seattle: University of Washington, 1996).

[4] Banz (1981); Eugene Fama and Kenneth French, "The Cross-Section of Expected Stock Returns," *Journal of Finance* 47(2) (1992):427–465. Given this lack of consensus about whether these alternative measures of size are related to returns, I focus on a metric for which there appears to be consensus in the literature (i.e., market capitalization) as the measure of size in this paper.

[5] Richard Roll, "A Possible Explanation of the Small Firm Effect," *Journal of Finance* 36(4) (1981):879–888; Fischer Black, "Beta and Return," *Journal of Portfolio Management* 20 (1993):8–18; Jonathan Berk, "A Critique of Size-Related Anomalies," *Review of Financial Studies* 8 (1995):275–286; Dongcheol Kim, "A Re-Examination of Firm Size, Book-to-Market, and Earnings Price in the Cross-Section of Expected Stock Returns," *Journal of Financial and Quantitative Analysis* 32 (1997):463–489; John Cochrane, *Asset Pricing: Revised Edition* (Princeton, New Jersey: Princeton University Press, 2005); Brealey, Myers, and Allen (2011); Andrew Ang, *Asset Management: A Systematic Approach to Factor Investing* (Oxford: Oxford University Press, 2014).

adjustments related to a size effect, if necessary, should likely be made to the expected cash flows.[6]

In this paper, I first investigate how investors estimate their required rate of return when making investments. Note that there has been a substantial amount of empirical evidence that shows the poor performance of the CAPM. A prominent strand is the size effect, which began with Banz (1981) and continued on through the numerous size effect studies that have been published since that time.[7] Therefore, it would be instructive to know whether investors, who put their money on the line, use the CAPM or models that incorporate the size effect when determining their required rate of return. My review of the evidence finds that investors prefer the CAPM over models that include a size proxy, such as the Fama-French model. This could imply that most investors fall into one of two types. The first type includes investors that do not believe a size effect exists. The second type represents investors that believe a size effect exists, but they believe the impact should not be accounted for in the cost of equity (i.e., any impact attributable to or proxied by the size effect should be accounted for in the expected cash flows). Consequently, practitioners that augment their cost of equity with a size premium appear to be using a cost of equity that is inconsistent with most investors' actions.

Next, I analyze whether small capitalization stocks have outperformed large capitalization stocks after Banz (1981) was published. Many size effect studies include pre-1981 data, which have been demonstrated to bias the results towards finding a size effect.[8] In addition, there have been significant developments affecting small firms after the publication by Banz (1981), such as the proliferation of other size effect studies and the founding of small-firm mutual funds. Because of this structural shift, using data prior to 1981 is less relevant to understanding whether a size effect exists today. Consequently, I use actual returns from 1981 to 2016 in my analysis to capture all developments since this structural shift. If a size effect exists, we would expect small stocks to outperform large stocks. However, I find the opposite. From 1981 to 2016, small stocks actually underperformed large stocks. This result is inconsistent with there being a size effect in general, let alone a size effect that is relevant to the cost of equity.

Finally, I evaluate whether there is a common set of criticisms that affect the size effect studies that such studies have not been able to overcome. After my review of the literature, I find that the size effect articles likely suffer from at least one of two major criticisms. The first major criticism is that the size effect lacks a theoretical basis. Without a theoretical basis, we cannot understand why size should matter. The second major criticism is that the results in size effect studies are susceptible to data mining criticisms. The data mining criticism can stem from the lack of theoretical basis, but it can also be an independent issue, as small changes to the assumptions and/or inputs used may make the findings of many size effect studies go away. Recall that the scientific method puts the burden of proof on the party that has claimed to have observed an anomaly, i.e., those finding that a size effect exists.[9] However, the consistency of these two criticisms across the size effect studies since 1981 suggests that the size effect studies may have not met the required burden of proof.[10]

Investors Do Not Appear to Demand Compensation for Size

Whether investors demand compensation for size goes to the heart of whether there is a size effect that is relevant when estimating the cost of equity. There is extensive literature that shows the CAPM does not perform well empirically and that additional risk factors may need to be added to models when estimating the discount rate. However, given the proliferation of size effect studies in the academic and practitioner literature since the 1980s, it would be insightful to understand whether these size effect studies have had an impact on investors when investors determine their required rate of return. In this section, I analyze the evidence indicating whether investors' actions when setting their discount rate is consistent with the CAPM or models that incorporate additional risk factors, such as size. If investors, who put their money on the line, do not demand a compensation for size in their required rate of return, we would expect to observe that investors prefer to use the CAPM when estimating their required rate of return. Otherwise, we would observe that investors prefer to use a multifactor model that includes a size proxy, such as the Fama-French model.

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[6] Note that there are some studies that find a size effect when one accounts for changes to the cash flows. See Kewei Hou and Mathijs van Dijk, "Profitability Shocks and the Size Effect in the Cross-Section of Expected Stock Returns," paper presented at the 2011 European Finance Association 38th Annual Meeting (Stockholm, Sweden: European Finance Association, 2011).

[7] Banz (1981).

[8] For example, see Black (1993) (footnote 5).

[9] Stephen Carey, *A Beginner's Guide to Scientific Method*. 4th ed. (Boston, Massachusetts: Wadsworth, Cengage Learning, 2011).

[10] Interestingly, although there is no evidence that the burden of proof has shifted, valuation practitioners that do not add a size premium often find themselves in the position of having to defend their choice of not adding a size premium. See, for example, Aswath Damodaran, "The Small Cap Premium: Where Is the Beef?" *Musings on Markets Blog* (April 11, 2015), accessed at http://aswathdamodaran.blogspot.com/2015/04/the-small-cap-premium-fact-fiction-and.html, May 18, 2017.

The following three relevant studies provide helpful insights to answer my query. First, a 2017 study by Berk and van Binsbergen used mutual fund flows from a sample of 4,275 mutual funds covering the period January 1977 to March 2011.[11] This study focused on the behavior of mutual fund investors, which covers a great majority of households with an annual income of over $100,000. The authors found the CAPM was the model that was most consistent with how mutual fund investors set their required rate of return. Moreover, the authors also found that the additional factors in the Fama-French model, which includes a size proxy, did not add explanatory power.[12]

Second, a 2015 study by Pinto et al. surveyed professional equity analysts that are members of the CFA Institute.[13] The equity analysts in their sample spent a majority of their time evaluating individual securities for purposes of making investment recommendations or portfolio decisions. The authors found that 68% of the 1,436 equity analysts that responded to their survey used the CAPM. By contrast, the authors found that the Fama-French model was used by less than 5% of respondents.

Last, a 2002 study by Graham and Harvey surveyed Fortune 500 chief financial officers (CFOs) and financial officers from 4,440 firms who were members of the Financial Executives Institute.[14] Among other things, the survey investigated how the respondents made capital budgeting (i.e., investment) decisions. Based on the survey responses, the authors found that over 70% of their survey respondents always or almost always used the CAPM. Interestingly, a multifactor CAPM only ranked third and was used less frequently than the simplistic approach of using the firm's average stock return as the cost of equity.

The wide cross section of investor types, with varying degrees of financial sophistication (i.e., from individual investors to professional equity analysts and financial executives), and the date range covered in these studies add to the robustness of the results. These results are also consistent with academic research showing that, despite the empirical evidence against the CAPM, the CAPM may still provide a reasonable estimate of a project's cost of capital.[15]

These results imply that most investors fall into one of two types: (1) investors that do not believe a size effect exists and, therefore, do not demand compensation for it, or (2) investors that believe a size effect exists, but believe the adjustment for the size effect is not made in the cost of equity. For example, any necessary adjustment could be done in the expected cash flows. Consequently, practitioners that augment their cost of equity with a size premium expose themselves to using a cost of equity that is inconsistent with how most investors set their required rate of return.

Small Stocks Do Not Outperform Large Stocks

The basic premise of the size effect is that small stocks outperform large stocks on a risk-adjusted basis. In this section, I test this premise by first running a simple test that compares how small capitalization stocks perform relative to large capitalization stocks on a raw return basis. I used value-weighted size-based decile returns obtained from Kenneth French's Data Library. I used the smallest size-based decile as a proxy for small stocks and the largest size-based decile as a proxy for large stocks. I performed my comparison over the period 1981 to 2016, which is the period after the publication of the first size effect studies and the founding of small-cap mutual funds. My analysis shows that $100 invested in small stocks would have grown to $3,221 over the period, while the same $100 invested in large stocks would have grown to $3,774. In other words, small stocks underperformed large stocks by 12% over the period 1981 to 2016. Since small stocks already underperformed large stocks on a raw return basis, it follows that small stocks would underperform large stocks even more on a risk-adjusted basis, because small stocks are assumed to have higher risk or betas relative to large stocks.[16] This result is inconsistent with the existence of a size effect, let alone adjusting the cost of equity with a size premium.

My finding is consistent with many finance textbooks that report the size effect vanishing in the 1980s. For example, one textbook explains: "The small-firm effect completely disappeared in 1980; you can date this as the publication of the first small-firm effect papers or the

[11] Jonathan Berk and Jules van Binsbergen, "How Do Investors Compute the Discount Rate? They Use the CAPM," *Financial Analysts Journal* 73 (2017):25–32.

[12] In unreported results, using data from Kenneth French's Data Library, I find that over the 1981 to 2016 period, the CAPM alone does as well as a two-factor model that consists of the excess market return and size proxy in explaining average portfolio returns. This also suggests that adding a size factor does not add explanatory power.

[13] Jerald Pinto, Thomas Robinson, and John Stowe, "Equity Valuation: A Survey of Professional Practice," Working Paper, September 9, 2015, accessed at the Social Science Research Network (SSRN), https://ssrn.com/abstract=2657717, May 22, 2017.

[14] John Graham and Campbell Harvey, "How Do CFOs Make Capital Budgeting and Capital Structure Decisions?" *Journal of Applied Corporate Finance* 15 (2002):8–23.

[15] See Zhi Da, Re-Jin Guo, and Ravi Jagannathan, "CAPM for Estimating the Cost of Equity Capital: Interpreting the Empirical Evidence," *Journal of Financial Economics* 103 (2012):204–220.

[16] In unreported results, I find that there is no reliable relation between size and betas. Using the same data from Kenneth French's Data Library, I find the beta of the largest size-based decile is indeed smaller than the beta of the smallest size-based decile. However, the beta of the portfolios in between these two extreme portfolios are in-line or, in most cases, higher than the beta of the smallest size-based decile. Hence, we do not observe a monotonic increase in betas as size decreases.

founding of small-firm mutual funds made diversified portfolios of small stocks available to average investors."[17] Another textbook notes: "Since the mid-1980s, however, there has been no size premium after adjusting for market risk."[18] One more textbook finds that "the abnormal performance of the DFA US 9-10 Small Company Portfolio, which closely mimics the strategy described by Banz (1981) . . . is insignificantly different from 1.0 in the period January 1982–May 2002 . . . Thus, it seems that the small-firm anomaly has disappeared since the initial publication of the papers that discovered it."[19] Note, however, that there are some studies that show the existence of a size effect for sample periods beginning in the 1980s, if one accounts for cash flow shocks.[20] This result suggests that, to the extent there is a size effect, the adjustment should be made to the expected cash flows and not to the cost of equity.

Some recent studies, however, have used a different sample period to analyze whether a size effect exists. For example, a 2016 study by Grabowski used the period from 1990 to 2014 and found a size effect.[21] Consistent with the author's findings, my method above shows that small capitalization stocks outperformed large capitalization stocks over the period 1990 to 2016. However, I am not aware of a justification in the article by Grabowski for using 1990 as the start date. If I choose an equally arbitrary start date of 2000 or 2005 instead of 1990, my analysis would find that small stocks once again underperformed large stocks. This result could imply that finding a size effect when using a sample period beginning in 1990 may not be robust. However, these results from alternative start dates are not as meaningful because, in my opinion, there is no credible justification for starting the sample period on those dates, as these later start dates would not have captured all the relevant data after the structural shift related to the size effect that began in the early 1980s.[22]

Size Effect Studies Consistently Suffer from Two Criticisms

Many articles have criticized the size effect studies. For example, some articles criticize the size effect studies for using an improper risk measure or exhibiting an errors-in-variables bias.[23] However, many of these issues are specific to a particular study and not reflective of a systematic issue. As such, I examined size effect articles in search of the criticisms that appear to be more common across the size effect literature, as existence of such long-running and unresolved issues provides evidence of criticisms that appear harder to surmount. I find that size effect studies suffer from at least one of two major criticisms: the lack of a theoretical basis for a size effect, and the susceptibility of the results to data mining. For ease of exposition, I elaborate on these two criticisms by using Banz (1981) and Fama-French (1992) as my primary examples, as these are two of the most commonly cited articles used to support the existence of a size effect.[24] Ultimately, without overcoming these two criticisms, it does not appear that the size effect studies can surmount the burden of proof required to establish an impact of the size effect on the cost of equity.

Lack of a theoretical basis

The first major criticism of size effect studies is the lack of a theoretical basis for finding a size effect. This means that the articles do not give us a reason why we should expect a size effect. For example, Banz (1981) concludes by admitting, "[t]here is no theoretical foundation for such an effect." As for Fama-French (1992), Fischer Black observes: "Fama and French also give no reasons for a relation between size and expected return."[25] There have been articles that have attempted to come up with a theoretical basis for the size effect, but, to the best of my knowledge, these theories have yet to obtain empirical confirmation beyond the simulated results provided.[26]

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[17] Cochrane (2005).

[18] Ang (2014).

[19] G. William Schwert, "Anomalies and Market Efficiency," in *Handbook of the Economics of Finance*, Edited by G. Constantinedes, M. Harris, and M. Stulz (Amsterdam: North-Holland, 2003).

[20] Hou and van Dijk (2011).

[21] Grabowski (2016).

[22] In addition, one would also need a sufficiently long period to analyze the size effect. Although there is no bright line test to determine the length of the sample period, Fama and French suggest a period of at least thirty-five years is necessary to be confident with the results. See Eugene Fama and Kenneth French, "Q&A: Small Stocks for the Long Run," *Fama/French Forum* (January 23, 2012), accessed at https://famafrench.dimensional.com/questions-answers/qa-small-stocks-for-the-long-run.aspx, May 21, 2017. Starting the sample period in 1981 satisfies this thirty-five-plus-year threshold.

[23] Roll (1981); (Kim 1997).

[24] For a recent survey of the size effect literature, see Mathijs van Dijk, "Is Size Dead? A Review of the Size Effect in Equity Returns," *Journal of Banking and Finance* 35 (2011):3263–3274. The author reaches similar findings regarding the two criticisms of size effect studies I discuss here. In particular, the author states: "In short, I find that the empirical evidence for the size effect is consistent at first sight, but fragile at closer inspection. I believe that more empirical research is needed to establish the validity of the size effect in both US and international stock returns. . . . I hesitate to recommend the application of an empirically inspired asset pricing model while there is ambiguity about the robustness and the causes of the size effect it incorporates."

[25] Black (1993).

[26] Jonathan Berk, Richard Green, and Vasant Naik, "Optimal Investment, Growth Options, and Security Returns," *Journal of Finance* 54 (1999):1553–1607; Joao Gomes, Leonid Kogan, and Lu Zhang, "Equilibrium Cross Section of Returns," *Journal of Political Economy* 111 (2003):693–732; Murray Carlson, Adlai Fisher, and Ron Giammarino, "Corporate Investment and Asset Price Dynamics: Implications for the Cross-Section of Returns," *Journal of Finance* 59 (2004):2577–2603.

Numerous studies have claimed that size may be a proxy for some other factor. For example, Banz (1981) asserts that size may be a proxy for one or more unknown factors that are correlated with size. This assertion has been disputed by some studies,[27] but some articles have claimed to identify specific factors. If such a factor can be identified, I believe that the first-best option is to adjust the expected cash flows rather than the discount rate for such effects. For example, the most commonly associated factor with size is illiquidity.[28] Some researchers have defined liquidity as "the speed at which a large quantity of a security can be traded with a minimal impact on the price and with the lowest transaction costs."[29] However, when costs and constraints to trading due to illiquidity are present, the price of a security could deviate temporarily from the value of the security.[30] This is particularly true when the large block trade has no signaling effect about the value of the firm, but the trade is brought about by an investor-specific need (e.g., the investor needs the funds to buy a yacht). Consistent with this, studies have modeled the impact of illiquidity as a temporary effect that is uncorrelated with fundamental value.[31] To the extent that the block trade is driven by value-relevant information, I believe it would be more appropriate to model the value impact of this effect by adjusting the expected cash flows when it occurs rather than adding a premium to the discount rate.

Data mining

The second major criticism of size effect studies is that the results are susceptible to data mining criticisms. This does not mean that size effect studies are all a product of data mining, but that it is difficult to objectively distinguish a legitimate method used to find the size effect from that of data mining.

One potential indicator of data mining is that the effect does not stem from theory.[32] Without a theory, the results are simply an artifact of the data used. Hence, given the above discussion on the lack of a theoretical basis plaguing size effect studies, the results of size effect studies are especially susceptible to the data mining criticism.

However, even if a credible theory does emerge, the volume of articles that question the robustness of many size effect studies still makes data mining a primary concern. For example, the results of many size effect studies are not robust to small changes in its inputs and assumptions. Let us take the choice of sample period as an example. Even Banz (1981) admits that the size effect is not very stable through time, and an analysis of the ten-year subperiods in his sample of New York Stock Exchange firms from 1926 to 1975 shows substantial differences in the magnitude of the size factor coefficient. As for Fama-French (1992), they use a sample period that overlaps with Banz (1981) but their results for the size effect go away when only the post-Banz data set is used.[33] In fact, a 2012 study by Fama and French confirmed the lack of a size effect when using a more recent sample period.[34] To overcome the criticism of potential data mining, authors of size effect studies must take great care in providing a justification for their sample period and ensure that their results are robust to equally plausible alternative sample periods.

Another sign of potential data mining is that studies have found that the size effect is only observed under very specific situations. For illustrative purposes, I discuss two common examples here. First, the size effect studies initially grouped firms into deciles or ten size-based portfolios.[35] As it became harder to find a size effect when grouping stocks into deciles, more recent size effect studies have begun grouping stocks into twenty-five size-based portfolios.[36] However, finding results by cutting and slicing the data to find patterns could be an indication of data mining.[37] At the very least, such a change in bucketing methodology makes it difficult to distinguish a legitimate result from that of data mining.

The second example is that a size effect is found only in January,[38] during which half of the effect is observed

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[27] Berk (1995).

[28] Yakov Amihud and Haim Mendelson, "The Effects of Beta, Bid-Ask Spread, Residual Risk, and Size on Stock Returns," *Journal of Finance* 44(2) (1989):479–486; Roger Ibbotson, Zhiwu Chen, Daniel Kim, and Wendy Hu, "Liquidity as an Investment Style," *Financial Analysts Journal* 69(3) (2013):30–44.

[29] Grabowski (2016).

[30] Ananth Madhavan, "Market Microstructure: A Survey," *Journal of Financial Markets* 3 (2000):205–258.

[31] Jack Bao, Jun Pan, and Jiang Wang, "The Illiquidity of Corporate Bonds," *Journal of Finance* 66 (2011):911–946.

[32] Andrew Lo and A. Craig MacKinlay, "Data-Snooping Biases in Tests of Financial Asset Pricing Models," *Review of Financial Studies* 3 (1990):431–467; Black (1993); Brealey, Myers, and Allen (2011).

[33] Black (1993); Andrew Ang and Joseph Chen, "CAPM over the Long Run: 1926–2011," *Journal of Empirical Finance* 14 (2007):1–40.

[34] Eugene Fama and Kenneth French, "Size, Value, and Momentum in International Stock Returns," *Journal of Financial Economics* 105 (2012):457–472.

[35] For example, see Marc Reinganum, "Abnormal Returns in Small Firm Portfolios," *Financial Analysts Journal* 37 (1981):52–56; Carlson et al. (2004).

[36] For example, see Grabowski (2016).

[37] Brealey, Myers, and Allen (2011).

[38] Jeffrey Jaffe, Donald Keim, and Randolph Westerfield, "Earnings Yields, Market Values, and Stock Returns," *Journal of Finance* 44 (1989):135–148; Christopher Lamoureux and Gary Sanger, "Firm Size and Turn-of-the-Year Effects in the OTC/NASDAQ Market," *Journal of Finance* 44 (1989):1219–1245; Carolyn Carroll, Paul Thistle, and K.C. John Wei, "The Robustness of Risk-Return Nonlinearities to the Normality Assumption," *The Journal of Financial and Quantitative Analysis* 27 (1992):419–435.

during the first five trading days of January.[39] The most common rationale provided for this so-called January effect is that investors sell stocks with capital losses at the end of the tax year, which is December in most cases, to offset taxable income during that same tax year. As it relates to small stocks, the argument is that small stocks are likely candidates for tax-loss selling because their high volatility would lead to higher probabilities of larger capital losses.[40] The January effect is then observed when the small stocks' price rebounds back to its fundamental value in the beginning of the new tax year, when the selling pressure has been alleviated. However, the January effect has no impact on the value of the firm, and the effect observed is a temporary price effect due to factors unrelated to the firm's fundamental value (i.e., the investors' tax strategy). Therefore, to the extent that the January effect exists and is a function of size, the effect is only temporary, and we should not expect it to have an effect when determining the firm's cost of equity.

Finally, another sign of potential data mining is when results are inconsistent with expectations. For example, if the size effect held up consistently, we would expect size premiums to monotonically increase as you go from a bucket of larger stocks to a bucket of smaller stocks. However, as an example, the size premium in excess of CAPM reported in the Ibbotson Stocks, Bonds, Bills, and Inflation (SBBI) Yearbooks for 2002, 2006, and 2015 violates this expectation.[41] Note that these inconsistencies persist despite the fact that data used by Ibbotson includes returns for several decades prior to 1981.

Conclusion

My review of the evidence and analysis suggest that there may be no size effect that is relevant to the cost of equity. First, I find that, even after the publication of numerous size effect studies, investors prefer to use the CAPM when setting their required rate of return when they make investments. In particular, they choose the CAPM over models that include a size proxy, such as the Fama-French model. Second, I show that over the post-Banz (1981) period (1981 to 2016), small capitalization stocks underperformed large capitalization stocks. This result appears to question whether a size effect exists at all, let alone whether there is a size effect that impacts the cost of equity. Finally, I determined that size effect studies have had difficulty surmounting two major criticisms: lack of a theoretical basis for a size effect, and susceptibility of results to data mining criticisms. Given all of these factors, practitioners should reconsider the standard practice of augmenting their cost of equity with a size premium. To the extent that there is a direct or indirect impact of size on the value of the firm, in my opinion, the first-best option is to make the relevant adjustment to the expected cash flows.

Note that there is a considerable amount of evidence that demonstrates the CAPM performs poorly in empirical tests. There have been criticisms of such studies, but a possible rationale for such poor performance may be missing risk factors that have yet to be identified. The results I present herein suggest that size may not be one of those missing risk factors. Therefore, finding these risk factors that replace size could be a fruitful area for future research.

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[39] Donald Keim, "The CAPM and Equity Return Regularities," *Financial Analysts Journal* 42 (1986):19–34.

[40] Philip Brown, Donald Keim, Allan Kleidon, and Terry Marsh, "Stock Return Seasonalities and the Tax-Loss Selling Hypothesis," *Journal of Financial Economics* 12 (1983):105–127.

[41] Another potential criticism of the size premium in excess of CAPM by Ibbotson is that the reported size premium is estimated using a methodology that is inconsistent with how valuation practitioners estimate their CAPM cost of equity. See Clifford Ang, "Why We Shouldn't Add a Size Premium to the CAPM Cost of Equity," NACVA QuickRead (February 15, 2017), accessed at http://quickreadbuzz.com/2017/02/15/shouldnt-add-size-premium-capm-cost-equity/, December 12, 2017.

Analysis of Company witness Walker's ROE Models

Average of Walker's ROE Estimates		
DCF		
Single-Stage	DCF Unadjusted	8.60%
	Leverage Adjustment	1.00%
	Overall DCF	**9.60%**
CAPM		
	CAPM Unadjusted	9.90%
	Size Adjustment	1.80%
	Leverage Adjustment	1.00%
	Overall CAPM	**12.70%**
Risk Premium	Risk Premium Unadjusted	10.50%
	Leverage Adjustment	1.00%
	Overall Risk Premium	**11.50%**
Total	**Average**	**11.27%**

Average of Walker's ROE Estimates Without Market Book Leverage		
DCF		
Single-Stage	DCF Unadjusted	8.60%
	Overall DCF	**8.60%**
CAPM		
	CAPM Unadjusted	9.90%
	Size Adjustment	1.80%
	Overall CAPM	**11.70%**
Risk Premium	Risk Premium Unadjusted	10.50%
	Overall Risk Premium	**10.50%**
Total	**Average**	**10.27%**

Average of Walker's ROE Estimates Without Market Book Leverage and Size Adjustment		
DCF		
Single-Stage	DCF Unadjusted	8.60%
	Overall DCF	**8.60%**
CAPM		
	CAPM Unadjusted	9.90%
	Overall CAPM	**9.90%**
Risk Premium	Risk Premium Unadjusted	10.50%
	Overall Risk Premium	10.50%
Total	**Average**	**9.67%**

Average of Walker's ROE Estimates Weighted 2/3 single-stage DCF and 1/3 CAPM		
DCF		
Single-Stage	DCF Unadjusted	8.60%
	Leverage Adjustment	1.00%
	Overall DCF	**9.60%**
CAPM		
	CAPM Unadjusted	9.90%
	Size Adjustment	1.80%
	Leverage Adjustment	1.00%
	Overall CAPM	**12.70%**
Total	**Average**	**10.63%**

Average of Walker's ROE Estimates Weighted 2/3 single-stage DCF and 1/3 CAPM, and Without Market Book Leverage		
DCF		
Single-Stage	DCF Unadjusted	8.60%
	Overall DCF	**8.60%**
CAPM		
	CAPM Unadjusted	9.90%
	Size Adjustment	1.80%
	Overall CAPM	**11.70%**
Total	**Average**	**9.63%**

Average of Walker's ROE Estimates Weighted 2/3 single-stage DCF and 1/3 CAPM, and Without Market Book Leverage and Size Adjustment		
DCF		
Single-Stage	DCF Unadjusted	8.60%
	Overall DCF	**8.60%**
CAPM		
	CAPM Unadjusted	9.90%
	Overall CAPM	**9.90%**
Total	**Average**	**9.03%**

Average of Walker's Proxy Group Weighted 2/3 multi-stage DCF and 1/3 CAPM in Staff's DCF model		
DCF		
Multi-Stage	DCF Unadjusted	7.07%
	Leverage Adjustment	1.00%
	Overall DCF	**8.07%**
CAPM		
	CAPM Unadjusted	9.90%
	Size Adjustment	1.80%
	Leverage Adjustment	1.00%
	Overall CAPM	**12.70%**
Total	**Average**	**9.61%**

Average of Walker's Proxy Group Weighted 2/3 multi-stage DCF and 1/3 CAPM, and in Staff's DCF model Without Market Book Leverage		
DCF		
Multi-Stage	DCF Unadjusted	7.07%
	Overall DCF	**7.07%**
CAPM		
	CAPM Unadjusted	9.90%
	Size Adjustment	1.80%
	Overall CAPM	**11.70%**
Total	**Average**	**8.61%**

Average of Walker's Proxy Group Weighted 2/3 multi-stage DCF and 1/3 CAPM, and in Staff's DCF & CAPM model Without Market Book Leverage and Size Adjustment		
DCF		
Multi-Stage	DCF Unadjusted	7.07%
	Overall DCF	**7.07%**
CAPM		
	CAPM Unadjusted	9.54%
	Overall CAPM	**9.54%**
Total	**Average**	**7.89%**

Veolia Water New York

Implied Credit Metrics	**Company Position**	**Staff Position**
	RY1 (Jan 2025)	**RY1** (Jan 2025)
Net Income (Rate Base * Equity Ratio * ROE)	$53,734,067	$38,802,726
Depreciation and Amortization	$34,236,269	$33,638,661
Deferred Income Taxes	$6,210,408	$6,217,216
Rate Base	$965,571,736	$996,474,733
Capital Expenditures	$105,089,916	$87,322,200
Interest Expense (Total Debt * WACD)	$19,060,386	$23,437,086
Current Income Taxes	$11,569,985	$15,351,364
Accumulated Deferred Income Taxes	$100,864,604	$100,864,604
Long-Term Debt	$453,818,716	$558,025,850
Short-Term Debt*	$0	$0
Total Debt	$453,818,716	$558,025,850
Total Equity	$511,753,020	$438,448,883
Total Capitalization (Debt and Equity)	$1,066,436,340	$1,097,339,337
Changes in Working Capital (ΔWC)	($452,352)	($604,965)
Changes in Other Oper. Assets & Liab.-ST	$0	$0
Changes in Other Oper. Assets & Liabilities - LT	$0	$0
Other Operating Cash Flow & Non Cash Items	$0	$0
Dividend Payments	$53,734,067	$38,802,726
EBITDA (Net Income + Interest + Inc. Taxes + Dep. & Amort.)	$118,600,707	$111,229,837
FFO (Net Income + Dep. & Amort. + Def. Taxes)	$94,180,744	$78,658,603
CFO (FFO + ΔWC)	$93,728,392	$78,053,638
S&P Adjusted EBITDA	**$118,600,707**	**$111,229,837**
S&P Adjusted FFO	**$94,180,744**	**$78,658,603**
S&P Adjusted CFO	**$93,728,392**	**$78,053,638**
S&P Adjusted FOCF	**($11,361,524)**	**($9,268,562)**
S&P Adjusted DCF	**($65,095,591)**	**($48,071,288)**
S&P Adj. Debt	**$537,530,480**	**$641,737,614**
S&P Adj. Interest Expense	**$37,370,477**	**$41,747,177**

Standard & Poor's Credit Metrics	**S&P**	**S&P**
Funds from Operation/Debt	17.5%	12.3%
Debt/EBITDA (x)	4.53x	5.77x
(FFO + Interest)/interest	3.52x	2.88x
EBITDA/Interest	3.17x	2.66x
CFO/Debt	17.4%	12.2%
FOCF/Debt	-2.11%	-1.44%
DCF/Debt	-12.1%	-7.5%
Business Risk Profile	Excellent	Excellent
Implied Rating	BBB+	BBB