CV

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Areas of Interest

Research: Empirical studies in sustainable finance, corporate finance and investments.

Teaching: Sustainable Finance, Investments, Business Finance and Corporate Finance. I have also taught numerous courses and delivered seminars in many preparatory programs designed to prepare students to write exams for all three levels of the CFA program and the CSC for over 10 years.

Education

University of Toronto	Ph.D., Finance, 1993 - January, 1998
Saint Mary's University	M.B.A., Finance, 1987-1989
Saint Francis Xavier University	B.Ed., Secondary, 1983-84
Acadia University	B.A., Economics, 1979-1983

Career Experience

Queen's University	Professor of Finance Founding Chair, Institute of Sustainable Finance (July 2018-December 2023); Director of Master of Finance (July 2008 – June 2014; January 2017- December 2022)
Saint Mary's University	Associate Dean and Pengrowth Nova Scotia Professor in Petroleum Financial Management: (July 2007 – June 2008) Professor: (September 2006 – June 2007) Associate Professor: Finance (September 2000 - June 2001, July 2002 – August 2006) Assistant Professor: Finance (July 1998 - August 2000) Lecturer: Finance and Statistics, (1990-1993, Full Time)
York University	Assistant Professor: Finance (July 2001 – June 2002)
The University of Lethbridge	Assistant Professor: Finance (1997- 1998, Full Time)
The University of Toronto	Lecturer: Business Finance (Undergraduate and MBA) (1994-1997, Part Time)
Ryerson University	Lecturer: Investment Finance (1994-1997, Full Time)
WSC Investment Services	Instructor for CSC and CFA Seminars and Prepare Course Materials and Deliver Seminars for various professional organizations; (1996-present, Part Time)
Royal Bank of Canada	Commercial Lender; (1989-1990, Full Time)

Expert Witness Experience:

February-October 2023 – Industrial Gas Users Association (IGUA) of Ontario
Preparing evidence regarding an appropriate equity ratio for Enbridge Gas.

July 2022-October 2023 – Utilities Consumer Advocate (UCA) of Alberta
Prepared evidence regarding an appropriate ROE and capital structure for regulated Alberta utilities.

September 2019-April 2020 – Utilities Consumer Advocate (UCA) of Alberta
Prepared evidence regarding an appropriate ROE and capital structure for regulated Alberta utilities.

July-November 2018 – Newfoundland Consumer Advocate
Prepared evidence regarding an appropriate capital structure for Newfoundland Power.

September 2017-June 2018 – Utilities Consumer Advocate (UCA) of Alberta
Prepared and testified regarding an appropriate ROE and capital structure for regulated Alberta utilities.

April 2017-September 2018 – Utilities Consumer Advocate (UCA) of Alberta
Preparing evidence and testifying regarding appropriate risk margins for commodity risk for regulated Alberta utilities.

July-October 2016 – Manitoba Public Insurance
Prepared a report and testified regarding interest rate forecasts.

September 2015-July 2016 – Utilities Consumer Advocate (UCA) of Alberta
Prepared and testified regarding an appropriate ROE and capital structure for regulated Alberta utilities.

December 2015-June 2016 – Newfoundland Consumer Advocate
Prepared and testified regarding an appropriate capital structure for Newfoundland Power.

April-November 2014 – Utilities Consumer Advocate (UCA) of Alberta
Prepared and testified regarding appropriate risk margins for commodity risk for regulated Alberta utilities.

December 2013-August 2014 – Utilities Consumer Advocate (UCA) of Alberta
Prepared and testified regarding an appropriate ROE and capital structure for regulated Alberta utilities.

Publications:

Academic Journals:

“The Cost of Delaying to Invest: A Canadian Perspective,” 2022. Finance Research Letters, 50, 103242. Co-authored with Neal Willcott, Smith School of Business, Queen’s University.

“Post-Crisis M&As and the Impact of Financial Constraints” 2020. Journal of Financial Research, Vol 43 No. 2, 407-454. Co-authored with Ashrafee Hossain, Memorial University. Recipient of “Outstanding Article Award” for 2020.

“Institutional Investors, Monitoring and Corporate Finance Policies,” 2017. International Journal of Managerial Finance, Vol. 13, Issue No. 2, 186-212. Co-authored with Jun Wang, The University of Western Ontario. Outstanding Paper Award.

“The Cash Effect and Market Reaction over Three Decades,” 2016. Journal of Accounting and Finance, December 2016, 93-115. Co-authored with Fatma Sonmez, Queen’s University.

“An Efficient and Functional Model for Predicting Bank Distress: In and Out of Sample Evidence,” 2016. Co-authored with Greg Hebb, Dalhousie University. Journal of Banking and Finance, Vol. 64, March 2016, 101–111.

“Managerial Practices and Corporate Social Responsibility,” 2015. Co-authored with Najah Attig, Saint Mary’s University. Journal of Business Ethics, Vol. 131 (No. 1), 121-136.

“Organization Capital and Investment Cash Flow Sensitivity: The Effect of Management Quality Practices,” 2014. Co-authored with Najah Attig, Saint Mary’s University. Lead Article - Financial Management, Vol. 43 (No. 3), 473-504.

“Corporate Legitimacy and Investment-Cash Flow Sensitivity,” 2014. Co-authored with Najah Attig, Saint Mary’s University, Sadok El Ghoul, University of Alberta, and Omrane Guedhami, South Carolina University. Journal of Business Ethics, Vol. 121 (No. 2), 297-314.

“Debt Rating Initiations: Natural Evolution or Opportunistic Behavior?” 2013. Co-authored with Laurence Booth, University of Toronto, and Lynnette Purda, Queen’s University. Journal of Modern Accounting and Auditing, Vol. 9 (No. 12), 1574-1595.

“Institutional Investment Horizons and the Cost of Equity Capital,” 2013, Co-authored with Najah Attig, Saint Mary’s University, Sadok El Ghoul, University of Alberta, and Omrane Guedhami, South Carolina University. Financial Management, Vol. 42 (No.2), 2013, 441-477. Selected as one of 8 papers (since 2005) that was included in a Special Virtual edition on “Monitoring Management,” 2018.

“Institutional Investment Horizon and Investment-Cash Flow Sensitivity.” Co-authored with Najah Attig, Saint Mary’s University, Sadok El Ghoul, University of Alberta, and Omrane Guedhami, South Carolina University. Journal of Banking & Finance, Vol. 36, (No. 4), 2012, 1164-1180.

“Capital Market Developments in the Post-October 1987 Period: A Canadian Perspective.” Co-authored with Laurence Booth from the University of Toronto. Review of Accounting and Finance, Vol. 8 (No.2), 2009, 155-175.

"Cash Flow Volatility, Financial Slack and Investment Decisions," 2008, China Finance Review, Number 1, Vol 2, 63-86. Co-authored with Laurence Booth from the University of Toronto.

"The Investment Nature of Income Trusts and Their Role in Diversified Portfolios," Canadian Journal of Administrative Sciences. Co-authored with Greg MacKinnon from Saint Mary's University, (Vol 24(4)), 2007, 314-325.

"The U-Shaped Investment Curve: Theory and Evidence." Co-authored with Paul Povel, University of Minnesota, and Michael Raith, University of Southern California, Lead article, Journal of Financial and Quantitative Analysis, Vol. 42 (No. 1), March 2007, 1-39.

"Financial Constraints and Investment: An Alternative Empirical Framework." Co-authored with Bert D'Espallier, Hasselt University, Anales de Estudios Economicos y Empresariales, Vol. 17, 2007, 9-41.

"Dividend Smoothing and Debt Ratings." Co-authored with Laurence Booth and Varouj Aivazian, both from the University of Toronto. Lead article, Journal of Financial and Quantitative Analysis, Vol. 41(No. 2), June 2006, 439-452.

"International Corporate Investment and the Relationships between Financial Constraint Measures," Journal of Banking and Finance, Volume 30 (5), 2006, 1559-1580.

"Are U.S. Variables Good Predictors of Foreign Equity Risk Premiums?" 2006. Co-authored with John Schmitz, President, Sci-Vest Capital Management Inc., The Cyprus Journal of Sciences.

"Income Trusts: Past Performance and Future Prospects." Co-authored with Greg MacKinnon of Saint Mary's University. Canadian Investment Review, Winter 2005, 53-54.

"Dividend Policy and the Role of Contracting Environments" FSR Forum, December 2005, 13-20. Co-authored with Laurence Booth and Varouj Aivazian, both from the University of Toronto.

"Corporate Investment and Financial Slack: International Evidence," The International Journal of Managerial Finance, 2005, 140-163.

"Industry Affects Do Not Explain Momentum in Canadian Stock Returns," Investment Management and Financial Innovations, 2005(2), 49-60. Co-authored with John Schmitz, President, Sci-Vest Capital Management Inc., and David Doucette, Saint Mary's University.

"Do Emerging Market Firms Follow Different Dividend Policies from U.S. Firms?" The Journal of Financial Research, Fall 2003, 371-387. Co-authored with Laurence Booth and Varouj Aivazian, both from the University of Toronto.

"Dividend Policy and the Organization of Capital Markets." Journal of Multinational Financial Management, Spring 2003, 101-121. Co-authored with Laurence Booth and Varouj Aivazian, both from the University of Toronto.

"The Risk-Adjusted Performance of Closed-End Funds and the Impact of Discounts." Journal of Today, December 2002, 119-133. Co-authored with Greg Hebb of Dalhousie University and Greg MacKinnon from Saint Mary's University.

“Transactions Costs for TSE-Listed Stocks,” Canadian Investment Review, Spring 2002, 20-26. Co-authored with John Schmitz, President, Sci-Vest Capital Management Inc., and Kevin Kerr, TD Securities, Toronto.

“What Has Worked on Bay Street,” Canadian Investment Review, Winter 2001, 25-34. Co-authored with John Schmitz, President, Sci-Vest Capital Management Inc.

“The Sensitivity of Canadian Corporate Investment to Liquidity,” Canadian Journal of Administrative Sciences, September 2000, 217-232.

“Diversification with Canadian Stocks: How Much is Enough?” Canadian Investment Review, Fall 1999, 21-25. Co-authored with David Copp, Mount Allison University.

“The Relationship Between Firm Investment and Financial Status,” Journal of Finance, April 1999, 673-692. Received at least one vote from the editorial board for the top Corporate Finance Paper Award during the year of publication.

“Momentum in Canadian Stock Returns,” Canadian Journal of Administrative Sciences, September 1998, 279-291. Co-authored with Michael Inglis, University of Toronto. One of five nominations for “best 1998 CJAS paper.”

Books and Book Chapters:

Introduction to Corporate Finance, first five editions, John Wiley & Sons Canada Limited. The first three editions were co-authored with Laurence Booth from the University of Toronto (2007, 2010, 2013), and the fourth and fifth editions (2016, 2020) co-authored with Laurence Booth and Ian Rakita from Concordia University. This is an Introductory Canadian Finance text that was written from “scratch.”

Corporate Finance, First US Edition. Co-authored with Laurence Booth from the University of Toronto and Pamela (Petersen) Drake) from Virginia Commonwealth University. John Wiley & Sons. In progress – publication date 2013.

Investments: Analysis and Management, First, Second and Third Canadian Editions, co-authored with Charles P. Jones of North Carolina State University, John Wiley & Sons Canada Limited (1999, 2004, 2008). I was solely responsible for the development of all three Canadian editions, the first being based on an adaptation of the sixth U.S. edition, authored by Professor Jones.

The Canadian Securities Exam Fast Track Study Guide, First, Second, Third and Fourth Editions (2001, 2006, 2009, 2013) – sole author. Published by John Wiley & Sons Canada Limited.

Finance in a Canadian Setting, Sixth Edition, co-authored with Peter Lusztig and Bernard Schwab, both of the University of British Columbia, John Wiley & Sons Canada Limited, March, 2001. I was solely responsible for the development of this edition of the text, based on an adaptation of the fifth edition, authored by Professors Lusztig, Schwab and Randall Morck of University of Alberta.

Market Efficiency, a chapter in the CFA Institute Investment Series book entitled Investments: Principles of Portfolio and Equity Analysis (Wiley, 2011), which is currently used as CFA Level 1 material within the Candidate Body of Knowledge.

“Introduction to Financial Markets,” (on-line course). Developed all seven modules for the Bourse de Montreal, 2002.

“Derivatives for the Retail Investor,” (on-line course). Developed two modules (Forwards and Future, and Options) for the Bourse de Montreal, 2002.

“Derivatives for the Institutional Investor,” (on-line course). Developed two modules (Options and Derivatives for Equity and Index Products) for the Bourse de Montreal, 2002.

“Investment Strategies and Asset Allocation,” Chapter 5, Investment Management Techniques, The Canadian Securities Institute, 1999.

“Equity Securities,” Chapter 12, Investment Management Techniques, The Canadian Securities Institute, 1999.

Cases:

“Time Value of Money: The Buy versus Rent Decision,” with Stephen Foerster. Ivey Publishing, August 2014. Ivey Classic case – recognized as one of the most widely used Ivey cases of all time.

Conference Proceedings:

I have published numerous articles in conference proceedings, as summarized below:
European Financial Management Association annual conference, 2008, 2006, 2005, 2002.
Hawaii International Conference on Business, 2002.
Multinational Finance Society annual conference, 2001.
Atlantic Schools of Business annual conferences, 2000, 1998.
ASAC annual conferences, 2006, 2001, 2000.

Conference Best Paper Awards:

“The Information Content of Institutional Investment Horizon: Evidence from Firms’ Implied Cost of Equity,” 2012, Working Paper, Co-authored with Najah Attig, Saint Mary’s University, Sadok El Ghoul, University of Alberta, and Omrane Guedhami, South Carolina University. Chosen Best Paper in Banking and Finance – 2012 European Business Research Conference.

“Income Trusts: Why All the Fuss and What About the Future?” 2006. Co-authored with Greg MacKinnon from Saint Mary’s University. Chosen as the best paper in the Finance division for the 2006 ASAC Conference in Banff, Alberta.

“The U-Shaped Investment Curve: Theory and Evidence” 2004. Co-authored with Paul Povel, University of Minnesota, and Michael Raith, Rochester University. Presented at the 2004 NFA Conference and received award as the “Best Paper in Managerial Finance.”

“The Sensitivity of Canadian Corporate Investment to Liquidity.” Published in conference proceedings for the 1999 ASAC Conference in Saint John, New Brunswick.
Chosen as the best paper in the Finance division for this conference.

Conference Presentations:

Keynote Speaker (Finance Area) – ASAC 2012 Annual Conference.
I have presented papers at numerous conferences, as summarized below:
World Finance Conference, 2015, 2014, 2013, 2011, 2010.
Paris Financial Management Conference, 2014.
Northern Finance Association annual conferences, 2022, 2013, 2011, 2010, 2008, 2005, 2004, 2002, 2000, 1996.
Multinational Finance Society annual conferences, 2010, 2001, 1999.
European Financial Management Association annual conference, 2008, 2006, 2005, 2002.
Hawaii International Conference on Business, 2002.
Eastern Finance Association annual conferences, 2003, 2000.
Atlantic Schools of Business annual conferences, 2000, 1998, 1996.
ASAC annual conferences, 2006, 2000, 1999.
Financial Management Association annual conferences, 2013, 2011, 2010, 2008, 2005, 2004, 2001, 1999, 1996.
Southern Finance Association annual conference, 2022, 2016, 2008.

Finance Workshops (invited presentations):

Atlantic Canada CFA Society, 2006.
Melbourne Centre for Financial Studies, 2006.
Melbourne CFA Society, 2006.
Monash University (Caulfield), 2006.
University of Melbourne, 2006.
University of New South Wales, 2006.
University of Sydney, 2006.
University of Manitoba CGA Finance Conference 2005
Wilfred Laurier University, 2002.
University of Western Ontario, 2001.
York University, 2001, 2010.
Dalhousie University, 2001, 2013.
Queen's University, 2000.
Saint Mary's University, 2002, 2001, 2000, 1999.
Schulich School of Business, 2010.
Concordia University, 2013.
The University of Waterloo, 2015.

Research Grants

Co-investigator for an Insight Development Grant in the amount of $55,626 from the Social Sciences and Humanities Research Council of Canada (SSHRC) for the 2016 to 2018 period (Principal investigator – Jun Wang of the University of Western Ontario).

Co-investigator for a Standard Research Grant in the amount of $129,980 from the Social Sciences and Humanities Research Council of Canada (SSHRC) for the 2013 to 2017 period (Principal investigator - Najah Attig of Saint Mary's University).

Awarded four Research Grants of $90,000 each over three years from the Smith School of Business at Queen's University (2008-11; 2011-14; 2014-17; 2018-2020).

Principal investigator for a Standard Research Grant in the amount of $60,500 from the Social Sciences and Humanities Research Council of Canada (SSHRC) for the 2008 to 2011 period.

Co-investigator for a Standard Research Grant in the amount of $111,000 from the Social Sciences and Humanities Research Council of Canada (SSHRC) for the 2006 to 2009 period (Principal investigator - Najah Attig of Saint Mary's University).

Principal investigator for a Standard Research Grant in the amount of $70,118 from the Social Sciences and Humanities Research Council of Canada (SSHRC) for the 2003 to 2006 period.

Awarded a Research Grant of $25,000 per year for three years from the Schulich School of Business at York University (July 2001).

Principal investigator for a Standard Research Grant in the amount of $61,530 from the Social Sciences and Humanities Research Council of Canada (SSHRC) for the 1999 to 2002 period.

Awarded Research Grant for $1,500 from Saint Mary's University (2003-2004).

Awarded Research Grant for 2,500 from Saint Mary's University (2002-2003).

Awarded Research Grant for $2,500 from Saint Mary's University (2000-2001).

Awarded Research Grant for $3,030 from Saint Mary's University (1999-2000).

Awarded Research Grant for $2,000 from Saint Mary's University (1998-99).

Research Grant in the amount of $20,000 from the Intellectual Infrastructure Partnership Program (IIPP) at the University of Lethbridge (1997-98).

Research Grant from the University of Lethbridge Research Fund for $4,500 (1997-98).

Work-in Progress

"The Leverage-Profitability Puzzle Revisited," 2018, Working Paper. Co-authored with Alan Douglas, and Tu Nguyen, both from the University of Waterloo.

"Does Dual Holdings by Institutional Investors Make a Big Difference?" 2018, Working Paper. Co-authored with Jun Wang, the University of Western Ontario, and Keke Song, University of Melbourne.

"Leverage, Financial Flexibility, and Dividend Smoothing: An Empirical Investigation," 2018, Working Paper. Co-authored with Alan Douglas, the University of Waterloo.

Professional Activities

Member - CFA Society Toronto Advisory Council (January 2018-present)
Editorial Board – *Managerial Finance* (July 2017-present)
Associate Editor (Finance area) for the *Canadian Journal of Administrative Sciences* (2017-2020); Editor (Finance area) (2014-2016).
Associate Editor for the *European Journal of Finance* (2008-present).
Editorial Advisory Board – Investor Lit (2013-present)

Senior Advisor – Toronto CFA Professional Development Committee (2014-2021); Chair (2013-14); Vice-Chair (2012-13)

Chair – Awards Committee – CFA Toronto Board of Directors (2008-2011)

President - Board of Directors for the Atlantic Canada CFA Society (2007-2008). Served on the board from 2001 to 2008.

Editorial Board – *Canadian Investment Review* (2008-2011).

Served as a reviewer for the *Review of Financial Studies*, the *Journal of Financial and Quantitative Analysis*, *Journal of Business, Financial Management, Journal of Money, Credit and Banking,* the *Journal of Banking and Finance,* the *European Journal of Finance*, the *Journal of Corporate Finance*, the *Journal of Applied Economics*, the *Multinational Finance Journal, Financial Review, Journal of International Financial Management*, the *International Review of Economics and Finance*, the *Canadian Journal of Administrative Sciences,* the *Review of Financial Economics, the Journal of Risk Finance,* and for the *Journal of Management and Governance*.

Reviewer for several SSHRC grant applications.

External reviewer/examiner for several tenure and renewal applications received for professors at other universities, as well as for Ph.D. dissertations.

Conference chair for 2001 Northern Finance Association Annual Meeting, held in Halifax.

Conference organizing committee and Reviewer for several conferences.

Completed the Chartered Financial Analyst (CFA) program, and awarded the CFA designation.

Completed the Professional Financial Planning Course offered by the Canadian Securities Institute, as well as the Canadian Securities Course (CSC).

Completed the Investment Funds Institute of Canada's Mutual Fund Course.

Prepared course materials for several "on-line" finance courses.

Instructor for Canadian Securities Course Seminars.

Prepared Course Materials for the Canadian Securities Institute.

Delivered Seminars for the Canadian Securities Institute on the Canadian Securities Course (CSC), Fixed Income Securities and Portfolio Management Techniques.

Student Supervision

External Examiner for several PhD students.

Supervisor, Queen's PhD Finance Students, Neal Willcott 2019-present, and Dhruv Baswal 2022-present.

Supervisor, Queen's MSc Finance Students, Michael Scott 2023-present, Ziyuan Liu 2023-present, Aashray Kaudinya 2023, Dhruv Baswal 2022, Ehsan Dehghanizadeh 2019, Wayne Charles 2010.

Served as co-director for the Investment Management of Portfolios in Atlantic Canada Training Program (IMPACT) at Saint Mary's University. This innovative program has students manage a portfolio of over $150,000 of "real" money (2005-2008).

Served as faculty advisor to several MBA students preparing their Management Research Project (MRP) in finance (FIN 669) to satisfy their MBA requirements:

Robert March, "Using Canadian and US Macroeconomic Variables to Predict Canadian Equity Risk Premiums" (1999).

Simon Sagar, "Do Canadian Investors Overreact?" (2000). Simon also presented his paper at the 1999 Atlantic Schools of Business (ASB) conference in Halifax.

Kevin Kerr, "Bid-Ask Spreads and Commissions on the TSE" (2000).

Scott LeBlanc, "An Investigation of Derivative Use: A Case Study of Cambior Inc." (2000).

David Doucette, "Industry Momentum in Canadian Stock Returns" (2001).

Balakrishna Murty, "The Effect of Board Composition on Firm Value: Some Canadian Evidence" (2003).

Bashir Jallow, "US Economic Factors and International Equity Risk Premia Predictability" (2005).

Kathy Isnor, "The Effect of Corporate Governance Policies on the Corporate Bond Rating" (2005).

References

Dr. Laurence Booth
Professor of Finance
University of Toronto
Phone: (416) 978-6311
Email: Booth@Rotman.utoronto.ca

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CEO of Melancthon Capital
Chancellor, Saint Mary's University
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Phone: (416) 930-2006
@JimLeechCM

Form A: Acknowledgement of Expert's Duty

FORM A

Proceeding:...EB-2024-0063.....

ACKNOWLEDGMENT OF EXPERT'S DUTY

1. My name is ....Dr. Sean Cleary....(*name*). I live at ...Oakville ~~Kingston~~ s.C.... (*city*), in the ....province.... (*province/state*) of ....Ontario.... .

2. I have been engaged by or on behalf of ..IGUA and AMPCO.. (*name of party/parties)* to provide evidence in relation to the above-noted proceeding before the Ontario Energy Board.

3. I acknowledge that it is my duty to provide evidence in relation to this proceeding as follows:
   (a) to provide opinion evidence that is fair, objective and non-partisan;
   (b) to provide opinion evidence that is related only to matters that are within my area of expertise; and
   (c) to provide such additional assistance as the Board may reasonably require, to determine a matter in issue.

4. I acknowledge that the duty referred to above prevails over any obligation which I may owe to any party by whom or on whose behalf I am engaged.

Date ....July 14, 2024....

Signature

Table 6: Data and Calculations

Refer to live excel chart filed separately.

Figure 1 and Table 1: Data and Calculations

Refer to live excel chart filed separately.

Figure 2: Data and Calculations

Refer to live excel chart filed separately.

Figure 3: Data and Calculations

Refer to live excel chart filed separately.

Figures 5 and 6: Data and Calculations

Refer to live excel chart filed separately.

Figure 7: Data and Calculations

Refer to live excel chart filed separately.

Figure 8: Data and Calculations

Refer to live excel chart filed separately.

Figures 9 and 10 – Data and Calculations

Refer to live excel chart filed separately.

Table 8 – Beta Estimates

Refer to live excel chart filed separately.

Tables 10 and 11 – Data and Calculations

Refer to live excel chart filed separately.

Table 12 – Data and Calculations

Refer to live excel chart filed separately.

Figures 13 and Table 13 – Data and Calculations

Refer to live excel chart filed separately.

Fernandez MRPs for 96 Countries in 2024 – March 2024

Figure A1.1 and Table A1.1 – Data and Calculations

Refer to live excel chart filed separately.

Hafer and Hein – 1989 - Forecasting Interest Rates

R. W. Hafer and Scott E. Hein

R. W. Hafer is a research officer at the Federal Reserve Bank of St. Louis. Scott E. Hein is the First National Bank at Lubbock Distinguished Scholar, Department of Finance, Texas Tech University. Kevin L. Kliesen provided research assistance.

Comparing Futures and Survey Forecasts of Near-Term Treasury Bill Rates

PREVIOUS research indicates that Treasury bill futures rates are better predictors of the future Treasury bill rate than forward rates. In a recent paper, MacDonald and Hein (1989) analyze 44 separate contracts delivered during the period 1977-87 for forecast horizons ranging from two days ahead to 91 days ahead. Their evidence shows that the Treasury bill futures rate generally delivers a smaller forecast error of the three-month Treasury bill rate than the forward rate implicit in the spot market, and that the forward rate adds little information about future Treasury bill rates that is not already incorporated into the futures rate. There also is evidence from other studies that survey forecasts of future Treasury bill rates contain information that improve upon forward rate forecasts. Studies by Friedman (1979) and Throop (1981), for example, reveal that survey forecasts often are more accurate than the forecasts from implicit forward rates.

Given the results of this research, a natural question to ask is "Does the Treasury bill futures rate provide a better forecast of future short-term interest rates than do survey forecasts?" In addition, since theories of financial market efficiency suggest that financial asset prices should include all available information, a related question is "Could one improve upon the Treasury bill futures forecasts using the information contained in the survey projections?"

Addressing these questions, the object of this paper, is interesting for several reasons. One is that forecasts of future interest rates are a crucial factor in forming investment strategies or purchasing plans. Incorrect interest rate forecasts can have large effects on investors' wealth. Moreover, to the extent that interest rate risk is directly related to the level of interest rates, accurately predicting the future level of rates is an important avenue to reducing interest rate risk exposure.[1] In a related vein, policymakers often consider the effect on interest rates as an important factor in predicting the outcome of policy changes. Knowing that the futures market provides an accurate gauge of the market's expectation for future rates provides a practical benchmark prediction

[1]On this, see Belongia and Santoni (1987).

to which policymakers can compare their forecasts.[2]

This article compares futures market and survey forecasts of short-term Treasury bill rates in two ways. First, considering general accuracy, we compare forecasting results of the two predictions over the 10-year period, 1977-87. General forecast accuracy is compared along with the extent of bias in the two reported forecasts.[3] Second, we investigate whether information in the survey forecast could reduce the forecast error of the Treasury bill futures market prediction. This relates to the efficiency of the Treasury bill futures market, an issue that previously has been addressed by comparing futures and forward rates in terms of the arbitrage opportunities that differentials in these two rates indicate.[4]

THE DATA

This study uses two quarterly interest rate forecasts: one from a widely circulated survey of market participants; the other from the Treasury bill futures market.

Survey Forecasts

The survey forecasts are published in the *Bond and Money Market Letter*.[5] This survey has been taken quarterly since 1969. On each survey date, approximately 40 to 50 financial market analysts representing a variety of financial institutions are asked for their point forecast of a number of different interest rates, three months and six months hence.[6] In this study, we focus on the survey forecasts of the three-month Treasury bill rate. The respondents' forecasts are compiled, and the mean value is published in the *Letter*. Since the approximate date of the survey response is easily identified, these forecasts can be easily matched with futures market rates for similar dates.[7] This feature makes the survey more attractive than other existing surveys for empirical comparison with interest rate forecasts from the futures market.[8]

Futures Market Rates

Trading in Treasury bill futures contracts takes place on the International Monetary Market (IMM) of the Chicago Mercantile Exchange between the hours of 8 a.m. and 2 p.m.[9] The futures contracts traded call for delivery of $1 million of Treasury bills maturing 90 days from the delivery day of the futures contract. The instrument and maturity of the deliverable instrument match well with the survey forecasts of the Treasury bill rate. These contracts call for delivery four times a year: March, June, September and December.[10]

The futures market forecasts were gathered so that the futures market rate was taken on the same approximate date that the survey

[2]As Poole (1978) notes, "Unless policymakers have solid evidence that their own forecasts are more accurate than market forecasts, they cannot afford to ignore the T-bill futures market." (p. 18)

[3]Belongia (1987) also compares the relative accuracy of futures and survey forecasts of Treasury bill rates, using the semiannual survey published by the *Wall Street Journal*.

[4]For examples of such studies, see Hegde and Branch (1985) or MacDonald, et al (1988) and the references cited therein.

[5]We would like to thank the publishers of the *Letter* for allowing us to use their survey results in this study. For previous analyses of this survey data, often referred to as the Goldsmith-Nagan survey, see Prell (1973), Friedman (1980), Throop (1981) and Dua (1988).

[6]The survey actually asks for forecasts of 11 different interest rates, ranging from the federal funds rate to conventional mortgage rates.

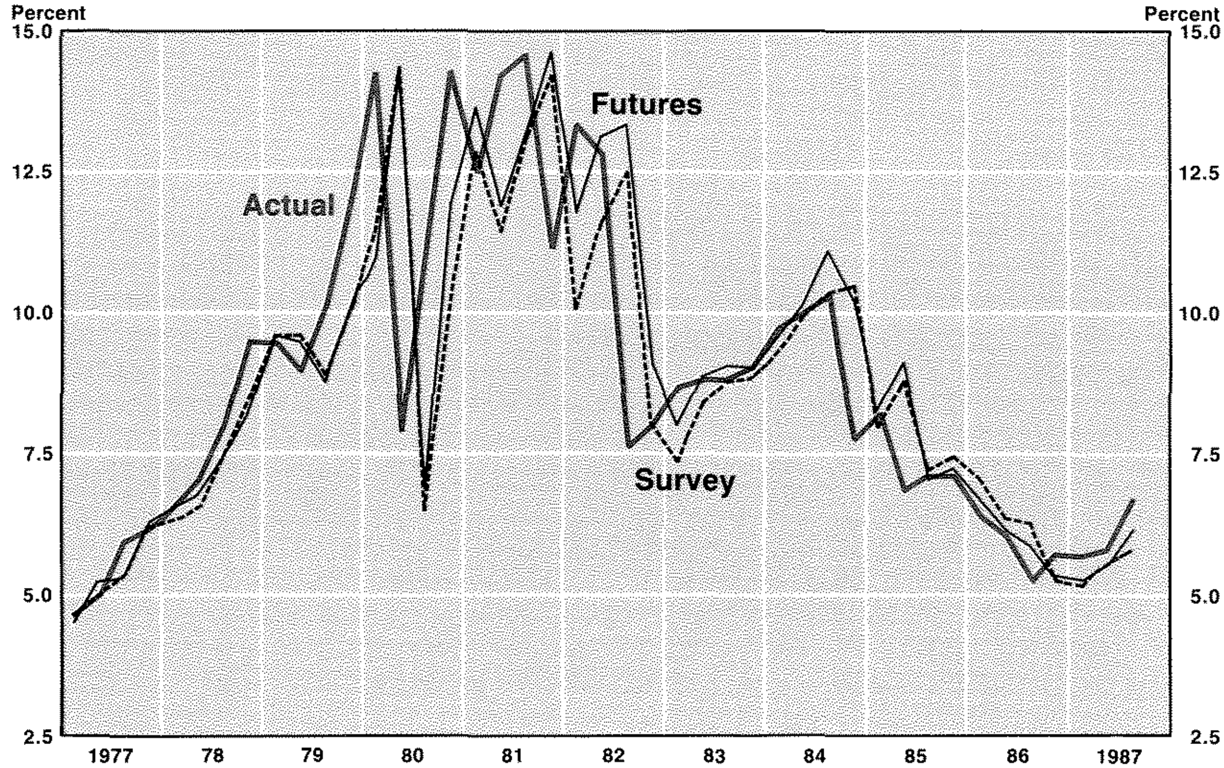
[7]The newsletter in which the survey results are published also provides the interest rates on the day the questionnaires are mailed and the latest close before publication, a period of about two weeks.

[8]One such survey is conducted by the American Statistical Association-National Bureau of Economic Research (ASA-NBER). This quarterly survey also asks participants to forecast the Treasury bill rate one quarter and two quarters ahead. Unfortunately, the questionnaire does not ask respondents for a forecast of the rate on any certain date in the future. It is unclear, therefore, whether the resulting forecast is a quarterly average, the peak rate for the quarter or the rate expected to hold at quarter's end.
Another interest rate survey already referred to is the semiannual *Wall Street Journal* poll of financial market analysts. This survey asks participants for their forecast of the three-month Treasury bill rate six months hence. Because this survey has been conducted only since December 1981, the limited number of forecasts restricts its usefulness for the type of empirical analysis used in this study.

[9]The discussion of the futures contract is based on information available in the *1983 Yearbook* of the IMM and the *1987 Yearbook*, volume 2, of the Chicago Mercantile Exchange.

[10]The volume of futures contracts traded on the IMM grew substantially from their introduction in January 1976, when the total volume for all delivery months was 3,576 contracts, through August 1982, when the number of contracts traded reached 738,394. Since 1982, however, the number of contracts traded has decreased: in December 1987, the total number of contracts was 131,575. The decline in the Treasury bill contracts also coincides with the introduction of a Eurodollar futures contract. This new contract may be viewed as a substitute for the Treasury bill contract.

Figure 1
T-Bill, Futures and Survey Forecasts
Forecast Horizon: Three Months



forecast was made. It is the approximate date, because the exact date when each survey respondent made his or her forecast cannot be determined. For example, the questionnaire asking "At what level do you see the following rates on September 30, 1987, and December 31, 1987?" was mailed to survey participants on June 16, 1987. The results of this survey subsequently were published on July 2, 1987.

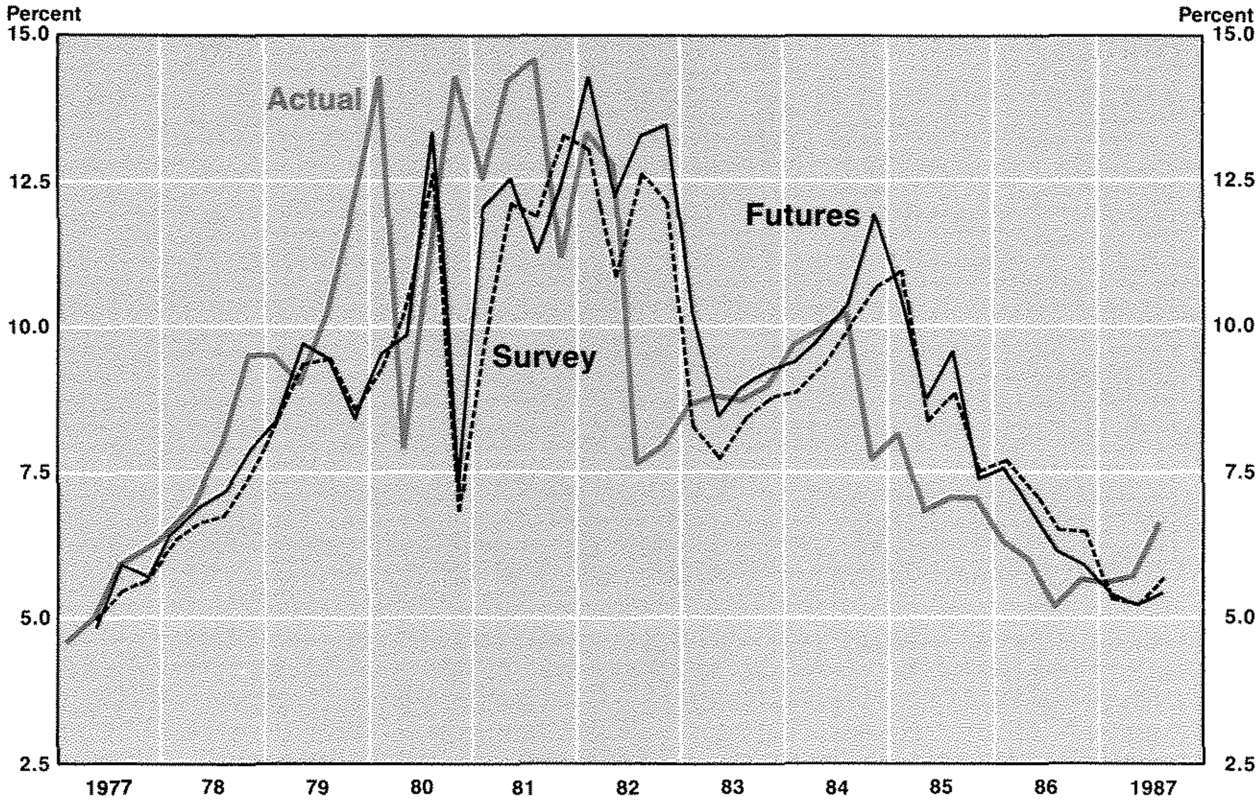
To make the analysis in this study tractable, we have chosen the midpoint of this two-week interval between the mailing date and publication date as the representative forecase date. Continuing with the example, two Treasury bill futures contracts were gathered from the *Wall Street Journal* for June 24, 1987: those for the September and December 1987 delivery dates.[11] These futures market predictions are then directly compared with the three-month and six-month-ahead Treasury bill rate survey forecasts published on July 2, 1987. For example, the July 1987 survey forecase of the September 30, 1987, Treasury bill rate was 5.81 percent. The futures market forecast was slightly higher, 6.15 percent. The actual rate turned out to be 6.64 percent.

A PRELIMINARY LOOK AT THE FORECASTS

To illustrate the overall relationship between the different series over the full sample period, we plotted the actual three-month Treasury bill rate and the different forecasts for the full sample period, from March 1977 through October 1987. These are shown in figures 1 and 2.

[11] It also should be noted that a slight disparity between the date of the two forecasts is expected to prevail. The survey participants presumably are projecting rates for the last business day of each quarter. Alternatively, the futures market is concerned with rates on the delivery day of the futures contract, usually the third Thursday of the final month in each quarter. The maximum disparity, however, is only six business days.

Figure 2
T-Bill, Futures and Survey Forecasts
Forecast Horizon: Six Months



Three-Month-Ahead Forecasts

Figure 1 presents the two different three-month-ahead forecasts along with the actual three-month Treasury bill rate. The general pattern shown is similar for both forecasts. In fact, both appear to have a closer relationship to each other than they do to the actual Treasury bill rates. For example, both forecasts overpredicted the actual rate in 1980.[12] The forecast error (actual minus predicted) for June 1980 from the futures market was −630 basis points; for the survey it was −642 basis points. Another relatively large forecasting error occurred when the actual rate fell sharply in late 1982. For September 1982, the futures market forecast error is −571 basis points compared with the survey forecast error of −487 basis points. Since 1984, although the differences have become smaller, the forecast errors from the futures market and the survey have tended to systematically overpredict rates.

To provide some statistical basis for assessing the accuracy of these two forecasts, table 1 presents summary measures of the relative accuracy of the two three-month Treasury bill forecasts over the full period and two subperiods.[13] Both the mean absolute error (MAE) and the root mean squared error (RMSE) are reported for the forecasts. As a benchmark, we also report the results based on a simple no-

[12] The Special Credit Control program was administered during this period. For a description of the program and a discussion of monetary policy during this period, see Gilbert and Trebing (1981).

[13] These subperiods represent those during which monetary policy was thought to be influenced by the behavior of the monetary aggregates (1980-82) and the behavior of interest rates (1983-87). Gilbert (1985) and Thornton (1988) suggest that the behavior of policy under borrowed reserve targeting was quite similar to that under a federal funds rate targeting procedure.

Table 1
Summary Forecast Statistics, Three-Month Treasury Bill Rate

Forecast	March 1977-October 1987 MAE	RMSE	March 1980-December 1982 MAE	RMSE	March 1983-October 1987 MAE	RMSE
			Three-month forecasts			
Futures	1.18%	1.90%	2.79%	3.32%	0.53%	0.86%
Survey	1.25	1.97	2.92	3.44	0.62	0.93
Naive	1.20	1.91	3.10	2.53	0.54	0.79
			Six-month forecasts			
Futures	1.52	2.28	2.94	3.64	1.03	1.48
Survey	1.60	2.23	3.10	3.63	1.03	1.30
Naive	1.68	2.31	3.12	3.63	0.83	1.01

NOTE: MAE is the mean absolute error; RMSE is the root mean squared error.

change forecast model, where the no-change model's forecast is the spot three-month Treasury bill rate observed on the same day that the futures rate forecast also is gathered.

The overall forecast accuracy of the three-month-ahead futures and survey predictions are quite close. For the full period, the MAE is 1.18 percent for the survey and 1.25 percent for the futures rate, both about the same as the no-change forecast (1.20 percent). The RMSEs also are quite similar across forecasts. The subperiod results reflect the difficulty in forecasting the Treasury bill rate during the early 1980s: the MAEs for the different forecasts are, on average, five times greater during the 1980-82 period than the 1983-87 period. Still, the forecast statistics indicate that the relative accuracy of the forecasts is similar.[14]

Six-Month-Ahead Forecasts

Figure 2 is a plot of the six-month-ahead forecasts together with the actual Treasury bill rate. The size and pattern of the two six-month-ahead forecast errors contrasts sharply with the three-month-ahead forecasts. Note, for example, the relative magnitude of the forecast errors during 1980 in figure 2 contrasted with figure 1. The prediction error for December 1980 from the futures rate was −704 basis points and, for the survey forecast, −744 basis points. For the three-month-ahead forecasts, the respective errors were positive and smaller: 239 basis points for the futures market forecast and 409 basis points for the survey forecast. Note also the magnitude of the post-1984 overprediction in figure 2 relative to figure 1.

The summary statistics in table 1 reveal that the accuracy of the six-month-ahead futures and survey forecasts is comparable for the full period and the subperiods. Generally, there is little difference between the MAEs and RMSEs for the two forecast series.

Bias Tests

Observers generally argue that rational individuals do not make the same forecasting mistake over and over again, because forecasts that consistently over- or underpredict the actual series presumably reduce the investor's wealth relative to forecasts that are unbiased. Consistent with the notion of wealth-maximization and rationality, forecasts therefore should be unbiased.

[14]This observation is corroborated by a statistical test of the futures and survey forecasts' mean square errors (MSE). This test, suggested by Ashley, Granger and Schmalensee (1980), revealed that one could not reject the hypothesis that the futures market and survey forecasts' MSEs are equal.

To test forecasts for bias, researchers usually estimate a regression of the form

$$(1)\ r_t = \alpha + \beta_{t-s}r_t^E + u_t ,$$

where r_t is the actual rate of interest at time t, $_{t-s}r_t^E$ is the expectation of the rate for time t held at time t-s, and u_t is a random error term.[15] The null hypothesis, that expectations are unbiased, implies the testable hypothesis that the estimated values of the coefficient α is zero *and* the coefficient β is unity. Moreover, the error term (u_t) should not display characteristics of autocorrelation.[16]

A problem in estimating equation 1 arises if the actual and forecast series are characterized by unit root processes.[17] In such a case, estimating equation 1 will produce downward-biased coefficient estimates, an increased probability of rejecting the null hypothesis and, therefore, an incorrect finding of bias when it doesn't exist.[18]

As an alternative to estimating equation 1 directly, one can test for bias by imposing the null hypothesis conditions and determine whether the data reject them. Imposing the null restrictions yields the relationship

$$(2)\ r_t - {}_{t-s}r_t^E = u_t .$$

If the actual interest rate series and the forecasts are characterized by unit root processes and the forecasts are unbiased, then the data also should reject the hypothesis that the forecast error (u_t) has a unit root. Moreover, it should be the case that $E(u_t) = 0$.

To implement this test procedure, we first test for unit roots in the actual and forecast interest rate series. Again, if it is shown that the actual interest rate series has a unit root, then so should the forecast series under the assumption of rational expectations.[19] To test for unit roots, the Dickey-Fuller (1979) test procedure is used wherein the change in each series is regressed on a constant and one lagged value of the serie's level. Specifically, a regression of the form

$$(3)\ \Delta X_t = \alpha_0 + \lambda X_{t-1} + e_t$$

is estimated, where Δ is the difference operator (i.e., $\Delta X_t = X_t - X_{t-1}$). If the t-ratio associated with the lagged variable is less than the relevant critical value, then we can reject the existence of a unit root.

The results of this test for the Treasury bill rate and its forecasts are reported in the upper half of table 2. In every instance, we find that the estimated t-ratio on the lagged level of the selected variable is greater than the 5 percent critical value, about -3.50.[20] This evidence indicates that we cannot reject the notion that each series has a unit root.

Given this finding, the forecast errors are examined to determine whether they do not contain unit roots, as hypothesized under the con-

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[15]Webb (1987) has argued that such tests may lead one to reject the null hypothesis when it is true. He argues that rejection of unbiasedness may reflect several factors, all of which are known to the econometrician *ex post* but not to the forecaster *ex ante*. He argues that forecasts that fail bias tests may in fact have originally been formulated optimally. This criticism is most forceful for examining forecasts of series that are revised many times following the original forecast date. Such a problem does not exist, however, with the interest rate series used here.

[16]This restriction, as Friedman (1980) notes, strictly applies only to the one-step-ahead forecasts.

[17]If the fundamental moving-average representation of some series X has an autoregressive representation, then it can be written in the form

$$[1-a(L)]\, X_t = e_t ,$$

where L is the lag operator (i.e., $LX_t = X_{t-1}$ and $a(L) = \Sigma a_i L^i$. The polynomial in the lag operator a(L) can be written as $a(L) = (1-B_1L)B(L)$. If there exists a root B_1 that is equal to unity, then the series X is characterized by a unit root. It is useful to note that a random walk is a particular type of unit-root process.

[18]We would like to thank Jerry Dwyer for pointing this out. This issue is discussed at length in Dwyer, et al (1989) from which the following draws.

[19]In other words, the process generating the expectations should be the same as the one generating the actual series.

[20]The critical value is taken from Fuller (1976), table 8.5.2. We should note that Schmidt (1988), extending the work of Nankervis and Savin (1985), argues that these critical values are incorrect in the presence of significant drift in the variable. Given the estimated constant terms found in the upper panel of table 2, the critical value to test for unit roots according to Schmidt is about -1.86 at the 5 percent level and about -2.60 at the 1 percent level. Using these critical values, our estimates suggest that, while unit roots are rejected at the 5 percent level, they are not at the 1 percent level.

If we take the results using the 5 percent level, then it is possible to estimate equation 1 directly. Doing so gives the following results: the calculated F-statistic and related marginal significance level testing the joint hypothesis that $\alpha = 0$ and $\beta = 1$ in equation 1 is 2.51 (0.09) for the three-month futures forecast; 3.26 (0.05) for the six-month futures forecast; 1.66 (0.20) for the three-month survey forecast; and 1.80 (0.18) for the six-month survey forecast. Except for the six-month futures forecast, these results indicate that unbiasedness cannot be rejected.

Table 2
Unit Root Tests on Actual Treasury Bill and Forecasts
Sample: March 1977-October 1987

	Estimated coefficient[1]	
Actual series	**Constant**	**Lagged level**
Treasury bill	2.17 (2.34)	−0.239 (−2.40)
Futures (3-month)	2.40 (2.40)	−0.263 (−2.48)
Survey (3-month)	2.84 (2.70)	−0.321 (−2.79)
Futures (6-month)	2.21 (2.26)	−0.240 (−2.34)
Survey (6-month)	2.07 (2.26)	−0.234 (−2.32)
Forecast errors		
Futures (3-month)	−0.112 (−0.37)	−1.203 (−7.66)
Survey (3-month)	0.201 (0.64)	−1.214 (−7.76)
Futures (6-month)	−0.122 (−0.35)	−0.698 (−4.55)
Survey (6-month)	0.128 (0.37)	−0.702 (−4.59)

[1]Values of t-ratios are reported in parentheses. The 5 percent critical value taken from Fuller (1976) is about −3.50.

dition of unbiasedness.[21] Regressing the change in the respective forecast error on a constant and a lagged level of the forecast error produces the results reported in the lower half of table 2. For both the three-month and six-month forecasts, the futures market and survey forecasts of the Treasury bill rate satisfy the condition of unbiasedness: the calculated t-ratio is always less than the critical value. These results indicate that the imposed restrictions associated with unbiased forecasts are not rejected.

The different forecast error series also are examined to decide whether their mean values differ from zero. In every instance, the hypothesis that the mean forecast error is not statistically different from zero could not be rejected. In fact, the largest t-statistic calculated is far below unity. Thus, the evidence is largely consistent with the notion that the futures market and survey forecast errors are unbiased.[22]

MARKET EFFICIENCY TESTS

The evidence to this point tells us little about the efficiency of the Treasury bill futures market. The hypothesis of market efficiency asserts that financial markets use all available information in pricing securities. If this is true, there should be no more accurate forecast of future security prices than that in today's price.

To investigate the efficiency of the futures market forecasts, a test proposed by Throop (1981) is used to determine whether knowledge of the survey forecast of Treasury bill rates could reduce the forecast error made by the futures market. The answer to this question can be found by estimating the regression

$$(4)\quad r_t - {}_{t-s}r^F_t = \delta({}_{t-s}r^S_t - {}_{t-s}r^F_t) + e_{s,t}\,,$$

where r_t is the three-month Treasury bill rate at date t, ${}_{t-s}r^F_t$ is the futures market rate at t-s for delivery at t, ${}_{t-s}r^S_t$ is the survey forecast taken at t-s for rates prevailing at t and $e_{s,t}$ is a random error term.[23] The hypothesis of market efficiency requires that the estimated value of the coefficient δ is zero, indicating that the information in the survey forecast already is incorporated in the futures market's projection. To see this, rewrite equation 4 as $r_t = \delta_{t-s}r^S_t + (1-\delta)_{t-s}r^F_t$. Under the market efficiency requirement that $\delta = 0$, the survey forecast drops

[21]As Dwyer, et al (1989) state, "A unit root in the forecast errors would indicate that the distribution of the forecast errors has a random walk component which has no counterpart in the innovations in the events being forecast." (p. 15)

[22]The bias of the no-change forecasts also was tested. Like the results based on the futures market and survey forecasts, the reported t-ratios allow us to reject the hypothesis of a unit root in the forecast errors of the no-change models. Moreover, the mean forecast error is not statistically different from zero.

[23]Throop (1981) used this approach to test the efficiency of Treasury bill forward rate projections and found evidence of inefficiencies in the forward market. Kamara and Lawrence (1986) and MacDonald and Hein (1989) use this approach and find that Treasury bill futures rates are more accurate forecasts when compared with the forward rates. Other examples employing a similar type of analysis are Fama (1984a,b) and French (1986).

Table 3
Efficiency Test Regressions Sample: March 1977-October 1987

Estimated Equations:

A) $r_t - {}_{t-s}r_t^F = \delta_1({}_{t-s}r_t^S - {}_{t-s}r_t^F)$

B) $r_t - {}_{t-s}r_t^F = \delta_2(r_{t-s} - {}_{t-s}r_t^F)$

Equation	δ_1	δ_2	$\bar{R}^2$	DW
		Estimated coefficients		
		Three-month forecasts		
A	0.08 (0.16)		−0.02	2.41
B		0.44 (0.95)	0.02	2.50
		Six-month forecasts		
A	0.71 (1.54)		0.05	1.40
B		0.44 (1.36)	0.04	1.58

NOTE: Absolute value of t-statistics in parentheses.

from the equation and one is left with $r_t = {}_{t-s}r_t^F + e_{s,t}$.

If the estimated value of δ is different from zero, however, knowledge of the differential between the survey forecast and the futures rate would significantly reduce the forecast error in the futures rate.[24] This would be inconsistent with the notion that market participants efficiently utilize all available information. In the terminology of Fama (1970), our test is a "semi-strong" form test of market efficiency, since all the information in the survey projections would not have been publicly available when the futures market was sampled.

Estimates of equation 4 to test the efficiency of both the three-month-ahead and the six-month-ahead Treasury bill futures market forecasts are reported as equation A in table 3.[25] The evidence indicates that the hypothesis of a semi-strong form of market efficiency cannot be rejected at the 5 percent level of significance. Using the information differential between the survey forecast and the futures rate, the estimated value of δ is only 0.08 (t = 0.16) for the three-month forecast horizon. For the six-month horizon, the estimated value of δ is 0.71 (t = 1.54). In both instances, we cannot reject the hypothesis of efficiency as applied to the futures market forecast. A weak-form market efficiency test also was considered by replacing the survey forecast with the current spot market rate. The result is reported as equation B in table 3. When compared with the no-change forecast, efficiency again cannot be rejected for the futures rate: the results indicate that, for the three-month and six-month forecasts, the estimated value of δ is never significantly different from zero.

Rewriting equation 4 as above also indicates that it imposes the restriction that the sum of the weights on the two forecasts sum to unity. We have re-estimated the equation without this restraint and found that we still could not reject efficiency of the futures rate forecasts when compared with either the survey or no-change forecasts.

The Role of the Revision in the Survey Forecast

Since the survey participants are asked for their three- and six-month-ahead forecasts every three months, they essentially are providing two forecasts of the same event, taken at two different points in time. For example, survey participants are asked in December of the previous year and then again in March to forecast the June Treasury bill rate. One piece of new information that survey respondents have in making their March forecasts is the revision of the December forecast itself. Nordhaus (1987) has suggested that, for forecasts to be efficient, the information in the revision also should be incor-

[24]This same procedure can be used to test if there is information in the futures rate that is not present in the survey forecast. In this case, the left-hand side of equation 4 is the forecast error from the survey prediction. The results from this test (not reported) indicate that the survey forecasts are efficient with respect to the futures market forecasts.

[25]The results reported are those excluding a constant term in the regression. Including a constant term does not alter the conclusions reached. Also, White's (1980) test failed to reject the null hypothesis of homoskedasticity in the residuals.

porated in the current forecast. Knowledge of the revision should not allow a reduction in the forecast error under the hypothesis of efficiency.

A similar argument can be applied to the futures rate forecasts. In particular, knowledge of the revision in the survey forecast of future Treasury bill rates should not help reduce the futures market's forecast error if the latter is formed efficiently. The survey's revision is part of today's information set and should already be incorporated into the market's projection.[26] To test whether knowledge of the survey's revision could help reduce the forecast error in the futures market, equation 4 is modified to include the survey revision itself:

$$(5)\ r_t - {}_{t-1}r_t^F = \alpha_0 + \gamma_1({}_{t-1}r_t^S - {}_{t-1}r_t^F) + \gamma_2({}_{t-1}r_t^S - {}_{t-2}r_t^S) + e_t .$$

The term $({}_{t-1}r_t^S - {}_{t-2}r_t^S)$ reflects the revision in the survey's forecast of next quarter's Treasury bill rate. Efficiency requires not only that the futures rate contains all the information in the survey forecast, but also that it reflects the survey forecast revision. If the futures rate forecast is efficient, estimated values of both γ_1 and γ_2 in equation 5 should not be different from zero.

The results from estimating equation 5 (with absolute value of t-statistics in parentheses) are:[27]

$$(6)\ r_t - {}_{t-1}r_t^F = \underset{(0.20)}{-0.066} + \underset{(0.18)}{0.104}({}_{t-1}r_t^S - {}_{t-1}r_t^F) \underset{(1.86)}{-0.312}({}_{t-1}r_t^S - {}_{t-2}r_t^S)$$

$\bar{R}^2 = 0.034 \qquad DW = 1.92$

The intercept of the equation is not statistically different from zero, indicating no bias in these projections. We also find that the estimated slope coefficients (γ_1 and γ_2) are not significantly different from zero using a conventional 5 percent level of significance. This outcome is consistent with the efficient markets hypothesis that there is little information in the survey forecast or its revision that is not already incorporated into the futures rate forecast.[28]

CONCLUSION

In this study, we compared futures market and survey forecasts of the three-month Treasury bill rate both three and six months ahead. Our test results generally support the perception that the forecasts are unbiased predictors of future rates. Moreover, futures market forecasts of near-term interest rates usually are as accurate as those produced by professional forecasters. Compared with a popular survey of professionals used in this study, we find little difference in the relative forecasting accuracy of the two. Our results also indicate that no information in the survey forecast or its revision could reliably improve upon the futures rate prediction.

This conclusion about market efficiency contrasts sharply with that found for the forward market. Previous evidence has shown that the Treasury bill forward rate does not incorporate all of the information contained in the same survey considered here. Such a conclusion, along with the evidence presented in this paper, is consistent with the belief that there is a time-varying premium in the forward rate that apparently is absent in the Treasury bill futures rate.

The results presented here should not be interpreted as proof that the Treasury bill futures market rate is always the most accurate interest rate forecast. The evidence does suggest, however, that for investment decisions and monetary policy discussions, the futures rate provides a useful measure of the market's expectation of future interest rates. Consequently, it is a valuable benchmark to which other forecasts can be compared.

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[26]The reader again is reminded that this is a semi-strong form efficiency since the information in the survey revision would not have been released to the public at the time that we sampled the futures rates.

[27]White's (1980) test indicated that we could not reject the null of homoskedastic residuals.

[28]We should note, however, that the γ_2 slope coefficient is significant at about the 7 percent level. Based on this level of significance, the result of estimating equation 5 is consistent with the notion that the futures rate forecasts may not be the optimal projection of the Treasury bill rate. Given the results in equation 6, the optimal forecast $({}_{t-1}r_t^0)$ would take the form

$${}_{t-1}r_t^0 = {}_{t-1}r_t^F - 0.312({}_{t-1}r_t^S - {}_{t-2}r_t^S) .$$

This result implies an overreaction on the part of the futures market to a revision. That is, if the survey revises its interest rate forecast upward, the optimal forecast would scale down the forecast from the futures market.

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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 analyze economists' forecasts of interest rates and exchange rates from the *Wall Street Journal*. We find that a majority of economists produced unbiased forecasts but that none predicted directions of changes more accurately than chance. Most economists' forecast accuracy is statistically indistinguishable from a random walk model in forecasting the Treasury bill rate, but many are significantly worse in forecasting the Treasury bond rate and the exchange rate. We also find systematic forecast heterogeneity, support for strategic models predicting the industry employing the economist matters, and evidence that economists deviate less from the consensus as they age.
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1. Introduction

Even though economists are warned in graduate school to avoid making forecasts that can readily be evaluated, professional economists' forecasts are a staple of the financial press. Several surveys of such forecasts are available and are thought to be valued by

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households, business firms, and even academic economists.[1] Accurate forecasts that vary little across economists presumably increase users' confidence that economists know what is likely to occur. Recent research such as Laster et al. (1999) and Lamont (2002) suggests, however, that economists may have strong incentives to differentiate their forecasts by making predictions that are more extreme than their true expectations.

We contribute to the forecast assessment literature by analyzing the quality of individual economists' interest rate and exchange rate forecasts from a highly visible but relatively little studied survey, the *Wall Street Journal's* panel of economists. This survey is particularly well-suited to assessing forecast quality because the participants' names and employers are published along side their forecasts, publicity which should give participants strong incentives to forecast carefully. We focus on interest rate and exchange rate forecasts – rather than a wider set of variables from the survey – for two reasons: first, interest rates and exchange rates are never reported and then subsequently revised, so the actual values economists were predicting is never an issue, unlike GDP or inflation;[2] and second, the interest rate and exchange rate forecasts have appeared in a consistent form in the *Wall Street Journal* surveys longer than other macroeconomic variables. We proceed by testing whether economists' interest rate and exchange rate forecasts are unbiased (allowing for nonstationarity), more accurate than naïve prediction rules, and affected by economists' strategic behavior.

The rest of the paper is organized as follows. Section 2 briefly reviews some of the past work on evaluating survey measures of expectations. Section 3 describes our data. Section 4 reports our empirical results and section 5 offers some conclusions.

2. Review of past work

Published assessments of professional economists' forecast quality have focused mainly on three issues. One is whether "consensus forecasts" (mean or median responses to surveys) produce misleading evidence about individual economists' unbiasedness and rationality.[3] Another is whether nonstationarity in the variables economists forecast invalidate the standard tests of forecast unbiasedness.[4] A third issue concerns heterogeneity of individuals' forecasts and strategic behavior by individuals as a potential source of the heterogeneity. Inquiry into this last issue has been deterred by a paucity of forecast series identifiable at the individual level, although a few studies have employed such data.

[1] Carroll (2003) reports evidence that households use reported forecasts of professional economists in forming their own expectations. Fildes and Stekler (2002) report on surveys that indicate corporations value economic forecasts. Economic researchers increasingly use professional economists' predictions as proxies of otherwise unobservable expectations in studying asset price determination, for example, Anderson et al. (2003). 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.

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

[3] Most such studies analyze inflation forecasts. While some conclude that individual forecasts are generally unbiased and may therefore be pooled (Keane and Runkle (1990); Batchelor and Dua (1991)), others find evidence of bias and conclude that pooling is inappropriate (Figlewski and Wachtel (1981); Bonham and Cohen (2001)).

[4] The standard test is to regress actual values being forecasted on the forecasts and to test whether the intercept is zero and the slope is one. The results from this literature are mixed, with some researchers finding economists' forecasts to be unbiased despite nonstationary in the actual data (Liu and Maddala (1992); Osterberg (2000)), and other researchers finding evidence of bias (Aggarwal et al. (1995); Schirm (2003)). It is noteworthy that these studies use consensus forecasts rather than individuals' forecasts; none examine interest rate forecasts.

Ito (1990) and MacDonald and Marsh (1996) find evidence of heterogeneous exchange rate expectations from individuals' forecast series, while Laster et al. (1999) and Lamont (2002) propose and test models of strategic behavior in which economists are rewarded for being right when others are wrong.[5] Using individual forecast data these last two studies report evidence consistent with strategic behavior, with Laster et al. finding that economists from some industries are more likely to deviate from the consensus and Lamont finding that economists make more extreme predictions as they age and when they own their own forecasting firms.[6]

This study investigates the three issues from the forecast assessment literature using individual economists' interest rate and exchange rate forecasts as reported by the *Wall Street Journal's* bi-annual survey of economists. Several researchers have previously used these data to examine forecast errors – among other matters – though sometimes without the relevant statistical tests.[7] To our knowledge, however, researchers have not previously used the *Wall Street Journal* data to test either unbiasedness of individual forecasts or strategic forecasting by individual forecasters.

3. The *Wall Street Journal* survey data

Since 1981 the *Wall Street Journal* has published forecasts of several economic variables at the beginning and mid-point of each year made by economists identified by name and employer. The January survey presents forecasts for the last business day of June while the July survey presents forecasts for the last business day of December. The surveys appear in the first week of January and July along with commentary and, more recently, discussion of the accuracy of the last set of forecasts.[8] The initial survey presented forecasts of the prime rate alone; forecasts of the Treasury bill and Treasury bond rates start in January 1982. Additional forecasts have been added over the years, including the dollar–yen exchange rate beginning in January 1989. Economists employed by banks and securities firms dominate the survey, but economists from industrial corporations, consulting firms, forecasting companies, universities and professional associations also participate.[9]

[5] Some researchers (Scharfstein and Stein (1990); Ehrbeck and Waldmann, 1996)) note that other incentive structures may produce more homogeneous forecasts.

[6] Laster et al. (1999) find evidence of strategic forecasting of real GDP in forecasts from the Blue Chip Economic Indicators; and Lamont (2002) finds evidence of strategic behavior in annual forecasts of real GDP growth, inflation, and unemployment reported by *Business Week*.

[7] Kolb and Stekler (1996) examine interest rate forecasts up to January 1990 and find little evidence that forecasters can predict the sign of interest rate changes. Greer reports similar evidence for various variables for 1984–1997 (Greer (1999)) and for the long-term interest rate for 1984–1998 (Greer (2003)). Cho (1996) evaluates the predictions of 24 forecasters who participated in all the surveys from December 1989 through June 1994. He finds that about 80% 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] 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.

[9] For respondents that appeared in at least six surveys from January 1982 through July 2002, the employer mix is as follows: banks (28 individuals and 391 observations), econometric modelers (5 and 109), independent forecasters (22 and 279), industrial corporations (5 and 41), securities firms (38 and 628), and others (12 and 202). This last group includes economists affiliated with universities, insurance companies, bond-rating firms, and professional associations.

We examine the six-month-ahead forecasts of the Treasury bill and Treasury bond rates that began in 1982 and the six-month-ahead forecasts of the dollar–yen exchange rate that began in 1989, ending with the July 2002 survey. The number of survey participants varies over time: only 12 economists participated in the January 1982 survey compared with 55 in the July 2002 survey. Considerable turnover of participants occurs as well. For several tests we restrict the sample to the subset of respondents who appeared in at least twenty surveys; 33 economists fit this criterion, each of whom made Treasury bill, Treasury bond and exchange rate forecasts, for a total of 99 forecast series.

In any given survey, the forecast errors made by the surveyed economists in predicting the interest rates and the exchange rates show considerable dispersion. For many surveys the errors are also largely of one sign, particularly the Treasury bond rate and exchange rate errors. Errors of one sign hint that while expectations vary across individuals, a common source exists for some of the error.[10]

4. Evaluating the survey data

4.1. Tests of unbiasedness

Unbiasedness is a requirement for rationality when a forecaster's loss function is symmetric about the forecast error. The usual unbiasedness test consists of regressing actual values on forecasts of those values and testing the joint hypothesis that the intercept and slope coefficients are zero and one, respectively:

$$\begin{aligned} &A_t = \alpha + \beta_{t-1}F_{it} + \varepsilon_{it}, \quad t = 1, \ldots, T \\ &H_{\mathrm{O}} : \alpha = 0,\ \beta = 1 \end{aligned} \tag{1}$$

where A_t is the time-t actual value, ${}_{t-1}F_{it}$ is the forecast of A_t made at time $(t-1)$ by forecaster i, and ε_{it} is a random error term.[11]

When A and F are nonstationary and not cointegrated, estimates of (1) may lead to misleading inferences about unbiasedness (Granger and Newbold, 1974). Indeed, unit root tests on levels and first differences of the actual values of the Treasury bill rate, Treasury bond rate, and the yen–dollar exchange rate sampled at six-month intervals show all three series to be nonstationary.[12] Hence the standard unbiasedness test is not valid.

Liu and Maddala (1992) and Lopes (1998) propose alternatives to the standard unbiasedness test for nonstationary data. Liu and Maddala suggest imposing the restrictions $\alpha = 0$ and $\beta = 1$ in (1) and using the data to compute forecast errors $(A - F)$; if these errors

[10] The correlation coefficient for the two interest rate forecast errors is 0.66, 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: the correlation between the Treasury bill rate and exchange rate forecast errors is 0.02; the correlation between the Treasury bond rate and exchange rate forecast errors is −0.07. All data are available from the authors on request.

[11] The joint hypothesis that $\alpha = 0$ and $\beta = 1$ is a sufficient condition for unbiasedness but a mean forecast error of zero is the necessary condition; see Holden and Peel (1990) and Fildes and Stekler (2002).

[12] The Augmented Dickey Fuller (ADF) statistics using 1 lag for the levels of the Treasury bill rate, Treasury bond rate, and yen–dollar exchange rate are −0.867, −0.970, and −2.396, respectively, indicating that each series has at least one unit root. The ADF statistics for the first differences of the levels data 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.

are stationary, the restrictions are supported and the forecasts are unbiased.[13] Lopes (1998) demonstrates that in finite samples a *t*-test of the null hypothesis that a forecast series' mean forecast error is zero has greater power than the Liu–Maddala test. To implement either test with our data we must determine, first, whether the *F*s are nonstationary and, if so, whether the forecast errors are stationary. We report our findings in Panel A of Table 1.

Using the 5% (10%) significance level, we find 88 (81) of the 99 interest rate and exchange rate forecast series to be nonstationary and 90 (95) of the 99 forecast error series to be stationary; in addition, we find all three survey-mean forecast series to be nonstationary and all three survey-mean forecast error series to be stationary. The Liu–Maddala unbiasedness test requires that the forecasts be nonstationary and the errors be stationary. More than three-quarters of the economists pass this test, with 79 (77) of the 99 forecast series passing the test at the 5% (10%) significance level.[14] All three survey-mean forecast series pass the Liu–Maddala test.

Panel B of Table 1 summarizes the results of the tests for zero mean forecast errors. Overall, 80 (75) of the 99 forecast-error series pass the test by producing *t*-statistics that fail to reject the null of zero mean forecast error at the 5% (10%) level.[15] The errors from the survey-mean forecasts are all insignificantly different from zero. Overall we find that 69 (62) of the 99 individual forecast series and all three survey-mean series show strong evidence of unbiasedness by passing both the Liu–Maddala and Lopes tests at the 5% (10%) level (Panel C, Table 1). We conclude that most of the experienced forecasters produce unbiased forecasts.

4.2. Measures of predictive ability

We measure the predictive accuracy of the surveyed economists two different ways: first, by their success in predicting the direction of interest rate and exchange rate changes;[16] and second, by their mean square forecast error (MSE) relative to the MSE of two benchmarks: the random walk model without drift and, for the exchange rate, the forward rate. We report statistical measures of predictive accuracy in the two panels of Table 2.

Panel A presents statistics on directional accuracy. For the Treasury bill rate and the exchange rate, the survey mean, or consensus, forecasts predicted the direction of change correctly about half the time, and the formal tests of independence of actual and predicted changes confirm that the mean predictions were not statistically different from a naïve model of no change (Schnader and Stekler (1990)).[17] For the long-term bond rate,

[13] Papers employing this restricted cointegration test include Hakkio and Rush (1989) and Osterberg (2000).

[14] For some individuals there are gaps, usually just one, in the forecast series. Ryan and Giles (1998) find that occasional missing values do not change the asymptotic distribution of the standard Dickey–Fuller tests and that ignoring gaps rather than filling the gaps with the last observation or interpolating, gave more powerful tests.

[15] In instances where the forecasts errors reject the null, the forecast series err on the high side: this is true of all the Treasury bill rate and exchange rate forecast series and about two-thirds of the Treasury bond rate forecast series.

[16] Leitch and Tanner (1991) argue that the direction of change is more closely related to profits than, say, the mean square error, at least for interest rate predictions.

[17] For each forecast series we performed Fisher's exact test, constructed contingency tables to compute the standard χ^2 statistic, and conducted the Pesaran and Timmerman (1992) test. 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.

Table 1
Tests of unbiasedness of *Wall Street Journal* forecasts[a]

	Treasury bill rate forecasts	Treasury bond rate forecasts	¥–$ Exchange rate forecasts
A. Liu–Maddala restricted cointegration test of unbiasedness			
1. Survey mean forecast series			
ADF statistic for the forecast series	−2.647	−2.459	−1.941
ADF statistic for the forecast errors	−4.309***	−5.570***	−2.838**
Passes tests for unbiasedness	Yes	Yes	Yes
2. Individual forecast series			
% of economists having nonstationary forecast series at the 5% (10%) level	82% (70%)	88% (82%)	97% (94%)
% of economists having stationary forecast errors at the 5% (10%) level	94% (100%)	97% (100%)	82% (88%)
% of economists passes unbiasedness test at 5% (10%) level	76% (70%)	85% (82%)	79% (82%)
B. Tests of zero average forecast error (Lopes, 1998)			
1. Survey mean forecast series			
t-statistic for the null of zero mean forecast error	−0.233	−0.135	−1.529
Passes test for unbiasedness	Yes	Yes	Yes
2. Individual forecast series			
% of economists having zero mean forecast errors at the 5% (10%) level	79% (73%)	73% (67%)	91% (88%)
C. Joint unbiasedness			
1. Survey mean forecast series			
Forecast series unbiased by both the Liu–Maddala and Lopes tests at the 5% (10%) level?	Yes	Yes	Yes
2. Individual forecast series			
% of economists having unbiased forecast series by the Liu–Maddala and Lopes tests at the 5% (10%) level	73% (58%)	61% (55%)	76% (76%)

Notes: *** and ** signify statistical significance at the .01 and .05 levels.
[a] Survey mean forecasts include all economists in each survey. Individual forecasts are for the 33 economists who appeared in at least 20 surveys.

however, the survey-mean forecast predicted the direction correctly only a third of the time, significantly worse than a naïve model as indicated by the rejection of independence by all three test statistics. Evaluating the individual forecasters gives similar results. For the Treasury bill and exchange rate, only about a fifth of the forecasters predicted the direction of change correctly less than 45% of the time. None were significantly better than a naïve model but few were significantly worse. For the long-term bond rate, however, more than half the forecasters predicted the direction of change correctly less than 45% of the time. None were significantly better than a naive model and several were significantly worse. In summary, when the surveyed economists are set the task of predicting the direction of interest rate and exchange rate changes, none out-predict a coin flip and several do worse.

Our second approach to measuring the surveyed economists' predictive accuracy is to compare their forecast errors to errors made by traditional benchmarks. For the interest rate and exchange rate forecasts we use as a benchmark the random walk model without drift;[18] and for the exchange rate we also use as a second benchmark, the forward exchange rate, obtained from the *Wall Street Journal*. We compared economists' forecast errors to the benchmarks' errors by computing the mean-square error (MSE) of each economist's and each benchmark's forecast series and then expressing each economist's MSE as a proportion of the benchmark's MSE; thus, outperforming the benchmark amounts to achieving a MSE ratio statistically less than one. We computed similar ratios for the mean or consensus forecasts. To test whether a ratio differs statistically from one we followed Fildes and Stekler (2002) and used the modified Diebold and Mariano (1995) test statistic proposed by Harvey et al. (1997).[19] We report our findings in Panel B of Table 2.

In general, the economists' predictions proved no more accurate than the traditional benchmarks, and were often worse.[20] The economists were most accurate in predicting the Treasury bill rate: 24% beat the random walk model, as did the survey mean, though none achieved MSE ratios statistically less than one. Consistent with the direction of change results, the economists were least accurate in predicting the Treasury bond rate: none beat the random walk model and 55% (70%) performed significantly worse than a random walk using the 5% (10%) significance level, though the MSE ratio of the survey mean was statistically indistinguishable from one. Though better at predicting the exchange rate, the economists still predicted poorly: none beat a random walk, and 18% (45%) were significantly worse than a random walk at the 5% (10%) level. The economists' exchange rate predictions were also less accurate than those of another poorly-performing predictor of exchange rates, the forward exchange rate: though 9% of economists outperformed the forward rate (none significantly), 15% (24%) predicted the exchange rate significantly worse than the forward rate at the 5% (10%) level.[21] The MSE ratio for the

18 Specifically, we let the actual values of the interest rates and exchange rate on the last business day in December and June represent forecasts for the last business day in June and December, respectively.

19 This statistic tests whether the mean difference between the squared forecast errors of the economist and the random walk model is significantly different from zero. The statistic has a t-distribution under the null hypothesis that the mean is zero.

20 Tables with the statistics for each of the economists participating in at least 20 surveys are available in an extended version of the paper available from the authors on request.

21 Chinn and Frankel (1994), find forward exchange rates to be biased predictors of the spot exchange rate.

survey mean exceeded one for both benchmarks but was significantly higher only for the random walk model benchmark.

In summary, economists participating in the *Wall Street Journal* surveys exhibit modest directional accuracy and large predictive errors.[22] We now turn to investigating explanations for the considerable spread of forecasts at each survey date.

4.3. Tests of systematic forecast heterogeneity and strategic forecasting

While the dispersion of individual forecasts could be random variation about the mean forecasts, previous researchers have found evidence of systematic heterogeneity, with some economists predicting lower values than the consensus, on average, and others predicting higher.[23] In this section we explore explanations of heterogeneity in the *Wall Street Journal* forecasts, first looking at systematic behavior by economists individually and in groups, and then looking at strategic behavior by economists.

To test for systematic heterogeneity in the *Wall Street Journal* forecasts we follow Ito (1990). Let the time t forecast of the jth economist, $f_{j,t}$, be a function of common information, I_t, an individual effect represented by an individual-specific dummy variable, g_j, and a random error term, $u_{j,t}$:

$$f_{j,t} = f(I_t) + g_j + u_{j,t}, \quad j = 1, \ldots, J, \; t = 1, \ldots, T. \tag{2}$$

Assume further that $f(I_t)$ contains a constant, permitting the average of the g_js to be set to zero. Averaging Eq. (2) across all economists in each time period and then subtracting the average from (2) yields

$$f_{j,t} - f_{\mathrm{AVE},t} = g_j + (u_{j,t} - u_{\mathrm{AVE},t}), \quad j = 1, \ldots, J, \; t = 1, \ldots, T. \tag{3}$$

We examine heterogeneity of forecasts by estimating (3) and testing the restriction that the estimated values of g_j are identical across economists. We do this for two sub-samples: one including all participants who were in at least six surveys, and another including all participants in at least twenty surveys, i.e., the economists studied in Sections 4.1 and 4.2.[24] We report our results in Panel A of Table 3.

The data clearly reject the null of no systematic differences across individuals. The F-statistics in the first row of Panel A all reject the null at the 1% level. But these statistics include forecasts of A. Gary Shilling, considered to be outliers by Lamont (2002), who dropped them from his sample.[25] Following Lamont we drop Shilling's forecasts and retest for systematic differences across economists. The F-statistics for these tests are in the second row of Panel A and also all reject the null at the 1% level, strong evidence of differences.

[22] As a referee pointed out, the 1980s and 1990s may have been particularly difficult decades for economists in predicting inflation, which may partly explain large errors in predicting interest rates and exchanges rates by the *Wall Street Journal* economists. We plan to investigate this issue in future work.

[23] Ito (1990) tests for heterogeneity in exchange rate forecasts made by Japanese economists and finds that economists employed in export and import industries have depreciation bias and appreciation bias respectively, 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 forecasters.

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

[25] We thank the referees for suggesting that we examine the impact of Shilling.

Table 2
Accuracy of forecast series[a]

Variable	Treasury bill rate	Treasury bond rate	¥–$ Exchange rate
A. Directional accuracy			
1. Survey mean forecast series			
% of correctly predicted directional changes	52%	33%	46%
Tests of independence of actual and predicted changes			
p-Value for Fisher's exact test	1.000	0.024**	0.687
χ^2	0.096	6.133**	0.491
Pesaran–Timmerman statistic	0.098	6.283**	0.509
2. Individual forecast series			
% of economists who correctly predicted the direction of changes in			
More than 55% of their surveys	33%	15%	42%
45% to 55% of their surveys	48%	30%	39%
Less than 45% of their surveys	18%	55%	18%
% of economists whose predicted and actual changes reject statistical independence at the 5% (10%) significance level indicating performance worse than a coin flip as determined by			
Fisher's exact test	3% (6%)	9% (12%)	0%
χ^2 test	6% (12%)	15% (21%)	0%
Pesaran–Timmerman test	6% (12%)	18% (21%)	0%

Variable	Treasury bill rate	Treasury bond rate	¥–$ Exchange rate	¥–$ Exchange
Benchmark	Random walk			Forward exchange rate
B. Predictive accuracy				
1. Survey mean forecast series				
Ratio of MSE of survey mean forecast to MSE of benchmark	0.9	1.1	1.2**	1.1
2. Individual forecast series				
% of economists whose MSE relative to the MSE of the benchmark model is				
1.4 or more	39%	67%	39%	33%
1.2 – 1.4	6%	24%	39%	33%
1.0 – 1.2	30%	9%	22%	24%
Less than 1.0	24%	0%	0%	9%
% of economists whose MSEs are statistically greater than the MSE of the benchmark model at the 5% (10%) level using the Diebold–Mariano test statistic	6% (15%)	55% (70%)	18% (42%)	15% (24%)

[a] See note a, Table 1.

** Signifies statistical significance at the 0.05 level.

To investigate whether heterogeneity of forecasts might originate from economists' industry focus, we estimate a version of (3) in which the g_js represent economists' industries of employment rather than economists themselves.[26] Panel B of Table 3 reports two sets of estimates of (3), one which includes Shilling's forecasts in the category of independently employed economists, and another which puts his forecasts in a separate category using a binary variable named for Shilling and a redefined dummy for the other independent economists. The importance of accounting for Shilling is apparent in the estimates. Estimates of the Treasury bill model which include Shilling with other independent economists lead to the inference that, on average, independents predict lower bill rates than economists employed elsewhere, forecasts of the latter being otherwise indistinguishable across industries. But when Shilling is removed from the independent economist category, independents and all other economists become indistinguishable and the coefficient estimates of the Shilling variable indicate that, on average, he predicts Treasury bill rates 60–66 basis points lower than the consensus forecast. Estimates of the Treasury bond model yield analogous results, except that economists employed by security firms and by independent firms, excluding Shilling, predict bond rates 12–15 basis points lower and 10 basis points lower, respectively, than the mean forecasts. Estimates of the exchange rate model indicate that Shilling predicts a dollar worth about 10 yen more than the mean forecast, on average, whereas econometric modelers predict a dollar worth 2–3 yen less. In summary, the Table 3 estimates yield evidence of systematic forecast differences across industries, although the very low R^2s indicate that little of the variation across economists can be explained by employer type.

The preceding evidence that individual economists' forecasts deviate systematically and substantially from the consensus but only partly due to employment effects raises the question of whether economists benefit from making extreme forecasts, sometimes much higher than the consensus and sometimes much lower. Laster et al. (1999) and Lamont (2002) suggest that economists who are rewarded for both forecast accuracy and "standing out from the crowd" may put forward more extreme predictions than if rewarded for forecast accuracy alone. To investigate this possibility we estimate a model combining elements of Lamont (2002) and Laster et al. (1999):

$$|f_j - f_{c(-j)}|_t = \beta_0 + \beta_1 \mathrm{AGE}_{j,t} + \beta_2 \mathrm{AVEDEV}(-j)_t + \sum \gamma_i D_{i,t} + \varepsilon_{j,t}$$
$$\text{for } j = 1, \ldots, J, \ t = 1, \ldots, T \tag{4}$$

Our dependent variable, which measures "standing out from the crowd," is the absolute difference between the jth economist's time-t forecast and the average time-t forecast omitting the jth economist. AGE, years of participation in the *Wall Street Journal* survey, controls for changing incentive structures: incentives might encourage young economists to gain publicity with extreme forecasts and older economists to protect their reputations with less extreme forecasts; alternatively, incentives might encourage young economists to hide their inexperience with less extreme forecasts and older economists to rely on their seasoning to make bolder forecasts. AVEDEV($-j$), which controls for variations in the spread of forecasts over time, is the average absolute deviation of the time-t forecasts from the average time-t forecast, omitting the jth economist. The dummy variables D_{jt} represent the employer types used above in investigating employments effects. Given the sensitivity

[26] We follow Laster et al. (1999) in categorizing the firms into industries, see Footnote 9.

Table 3
Estimates of heterogeneity model; dependent variable: Deviation of individual's time-t forecast from the mean time-t forecast

Data set	Panel 1 – Forecasters with at least 6 forecasts			Panel 2 – Forecasters with at least 20 forecasts		
A. Tests of differences across individuals						
Number of forecasters	93	93	86	33	33	33
Number of forecasts	1648	1650	1295	924	924	722
Forecast variable	T-Bill rate	T-Bond rate	Yen/$ rate	T-Bill rate	T-Bond rate	Yen/$ rate
F test for differences	4.09***	8.63***	6.76***	5.96***	15.38***	12.23***
F test for differences excluding Shilling	3.69***	7.62***	5.92***	5.24***	13.25***	9.99***

B. Tests of differences across industry of forecaster												
Number of forecasters	93	93	93	93	79	79	33	33	33	33	33	33
Number of forecasts	1648	1648	1650	1650	1295	1295	924	924	924	924	722	722
Forecast variable	T-Bill	T-Bill	T-Bond	T-Bond	Yen/$	Yen/$	T-Bill	T-Bill	T-Bond	T-Bond	Yen/$	Yen/$
Banks	−.0169	−.0169	−.0068	−.0068	.2853	.2853	.0076	.0076	.0110	.0110	−.4515	−.4515
	(.0423)	(.0417)	(.0411)	(.0401)	(.6368)	(.6201)	(.0623)	(.0610)	(.0595)	(.0575)	(.8656)	(.8256)
Corporate forecasters	−.0399	−.0399	−.0829	.0829	1.4928	1.4928	NA	NA	NA	NA	NA	NA
	(.0846)	(.0833)	(.0813)	(.0794)	(1.2359)	(1.2035)						
Securities firms	−.0583	−.0583	−.1546***	−.1546***	.2994	.2994	−.0550	−.0550	−.1249**	−.1249**	−.5773	−.5773
	(.0395)	(.0389)	(.0384)	(.0375)	(.5882)	(.5728)	(.0556)	(.0545)	(.0531)	(.0513)	(.7350)	(.7010)
Econometric models	−.0383	−.0383	−.0558	−.0558	−1.9478**	−1.9478**	.0376	.0376	.0203	.0203	−2.9860***	−2.9860***
	(.0581)	(.0572)	(.0564)	(.0551)	(.8854)	(.8621)	(.0723)	(.0708)	(.0691)	(.0667)	(1.0074)	(.9608)
Independent forecast firms	−.1352***	−.0523	−.2065***	−.1071**	.6321	−.6181	−.1488**	−.0058	−.2090***	−.0340	.7253	−1.3858*
	(.0451)	(.0459)	(.0439)	(.0442)	(.6646)	(.6638)	(.0638)	(.0665)	(.0610)	(.0627)	(.8293)	(.8290)
Shilling		−.6610***		−.8367***		10.6338***		−.6081***		−.7706***		10.2248***
		(.0851)		(.0819)		(1.3487)		(.0961)		(.0905)		(1.3690)
Constant	.0586	.0539	.1009***	.1009***	−.2011	−.2011	.0010	.0010	.0348	.0348	.2079	.2079
	(.0344)	(.0339)	(.0334)	(.0326)	(.5071)	(.4937)	(.0484)	(.0474)	(.0462)	(.0447)	(.6186)	(.5900)
$F1$[a]	2.52***	10.92***	9.48***	21.85***	2.28**	13.91***	2.85**	10.30***	6.55***	18.96***	3.83***	17.82***
$F2$	2.48**	.47	9.24***	6.38***	2.80**	3.26**	1.63	1.17	6.07***	4.48**	4.05**	3.15**
$F3$	.58	.60	8.06***	8.45***	3.38**	3.57**						
$F4$		.67		6.61***		2.61**						
Adjusted R^2	.005	.035	.025	.071	.005	.057	.008	.048	.024	.089	.016	.105

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

[a] $F1$ is the F-statistic for the test that all industry dummies are jointly zero; $F2$ is the F-statistic for the test that the dummies for banks, security firms, corporations, independents and modelers are jointly equal; $F3$ tests that all but independents are equal; $F4$ tests all dummies but Shilling jointly equal zero.

of employment effects to the treatment of Shilling we estimate two versions of (4), one including Shilling with other independently employed economists and another putting him in a separate category. Table 4 reports estimates of both versions of (4) for both panels of economists.

Our estimated models indicate an age-related incentive structure at odds with the one documented by Lamont (2002). Specifically, we find that economists tend to make predictions closer to the consensus as they age. While the estimated coefficients on AGE are all negative, they are larger in absolute value and generally statistically significant in models with the Shilling variable. This evidence of forecast mean reversion as economists age is contrary to Lamont's evidence for economists forecasting the real economy and inflation.[27] Though pervasive, our age effects are small in absolute terms: compared with a first-time respondent, a 10-year (20-survey) participant is about 6 basis points closer to the mean interest rate forecast and about one yen closer to the mean exchange rate forecast.

In addition to age effects, our estimated models indicate significant differences in incentive structures across industries. Compared to the left-out group, economists employed by banks and econometric modelers reported forecasts significantly closer to the mean interest rate and exchange rate forecasts; this result holds in both Panels 1 and 2. Forecasts of economists at securities firms were also closer to the means, but only in Panel 2. In Panel 1, forecasts of corporate economists were closer to the mean interest rate forecasts but not the mean exchange rate forecasts. Again, Shilling is a significant outlier, with forecasts deviating substantially from the mean forecasts for all three variables. With Shilling accounted for, there is no evidence that economists at independent forecasting firms produce more radical forecasts than the left out group, although they generally produce more radical forecasts than their counterparts at financial firms or the modelers.[28] The hypothesis that economists' forecasts deviate in absolute value equally from the average time-t forecast regardless of industry is soundly and universally rejected by the data, as indicated by the first row of F-statistics in Table 4. A second set of F statistics tests the hypothesis that the forecasts of economists employed by banks, security firms, corporations, and econometric modelers deviate equally from the mean. This hypothesis is rejected for the interest rate forecasts but not for the exchange rate forecasts. We conclude that incentive structures are one reason economists supply heterogeneous forecasts, with older economists, economists from the financial sector, and econometric modelers less likely to make extreme forecasts.[29]

[27] 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 in Panel 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.

[28] We also split the independent forecasting firms into those that are named for the forecaster-owner and those that are not. When the effect of Shilling is accounted for, there is no evidence that named firms make more radical forecasts.

[29] We also estimated models to test whether forecast accuracy, measured by the absolute value of the forecast error, varied across industries and found no evidence of significant differences.

Table 4
Estimates of incentives model; dependent variable: Absolute deviation of an individual's time-t forecast from the mean time-t forecast, excluding that individual

Data set	Panel 1						Panel 2					
Number of forecasters	93	93	93	93	79	79	33	33	33	33	33	33
Number of forecasts	1648	1648	1650	1650	1295	1295	924	924	924	924	722	722
Forecast variable	T-Bill	T-Bill	T-Bond	T-Bond	Yen/$	Yen/$	T-Bill	T-Bill	T-Bond	T-Bond	Yen/$	Yen/$
AGE	−.0012	−.0028***	−.0021**	−.0035***	−.0348**	−.0558***	−.0010	−.0024	−.0021	−.0032**	−.0269	−.0496**
	(.0011)	(.0010)	(.0010)	(.0010)	(.0146)	(.0145)	(.0015)	(.0014)	(.0014)	(.0013)	(.0200)	(.0197)
AVEDEV	.8574***	.8035***	.7037***	.6333***	.8366***	.8459***	1.0665***	.9714***	.9574***	.8481***	.6496***	.6579***
	(.0511)	(.0498)	(.0763)	(.0743)	(.0794)	(.0777)	(.0833)	(.0809)	(.1154)	(.1119)	(.1107)	(.1072)
Banks	−.0691**	−.0719**	−.1131***	−.1152***	−1.1486***	−1.1977***	−.1587***	−.1507***	−.2087***	−.2025***	−2.6618***	−2.616***
	(.0288)	(.0279)	(.0274)	(.0266)	(.4202)	(.4116)	(.0443)	(.0427)	(.0404)	(.0389)	(.5845)	(.5664)
Corporate forecasters	−.1067*	−.1212**	−.1136**	−.1249**	−.8043	−.9904						
	(.0581)	(.0564)	(.0546)	(.0529)	(.8270)	(.8102)						
Securities firms	−.0184	−.0196	−.0009	−.0014	−.4961	−.5050	−.1000***	−.0949**	−.0890**	−.0841**	−2.4447***	−2.3989***
	(.0267)	(.0259)	(.0254)	(.0246)	(.3855)	(.3775)	(.0390)	(.0375)	(.0356)	(.0343)	(.4933)	(.4780)
Econometric models	−.1178***	−.1143***	−.1497***	−.1460***	−1.3626**	−1.2967**	−.1965***	−.1900***	−.2349***	−.2295***	−2.5459***	−2.4734***
	(.0345)	(.0378)	(.0371)	(.0359)	(.5760)	(.5641)	(.0502)	(.0483)	(.0457)	(.0440)	(.6693)	(.6485)
Independent forecast firms	.0853***	.0056	.0565*	−.0197	.2819	−.4469	.0639	−.0684	.0547	−.0649	−.6380	−1.7593***
	(.0306)	(.0307)	(.0291)	(.0292)	(.4375)	(.4393)	(.0449)	(.0458)	(.0408)	(.0417)	(.5618)	(.5680)
Shilling		.5896***		.5406***		6.3000***		.5073***		.4543***		4.8104***
		(.0574)		(.0545)		(.9105)		(.0672)		(.0610)		(.9587)
Constant	.0844**	.1232***	.1640***	.2079***	1.7817***	2.0284***	.0832	.1321**	.1548***	.2071***	3.9494***	4.2635***
	(.0345)	(.0337)	(.0404)	(.0394)	(.5448)	(.5346)	(.0526)	(.0510)	(.0588)	(.0569)	(.7593)	(.7371)
F tests of differences across industries[a]	9.85***	4.47***	14.60***	10.76***	3.96***	2.41**	11.90***	5.00***	19.09***	11.34***	10.28***	7.69***
	[4.22***]	[4.57***]	[14.24***]	[15.31***]	[1.88]	[2.01]	[3.30**]	[.3.90**]	[11.74***]	[12.47***]	[.10]	[.10]
Adjusted R^2	.179	.228	.090	.146	.088	.125	.198	.257	.135	.198	.089	.145

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

[a] Top F-statistic tests that all industry dummies are jointly zero; bottom F-statistic tests that dummies for banks, security firms, corporations, and modelers are jointly equal.

5. Conclusions

Professional economists cannot take great pride in their forecasting abilities, judging from our analysis of the forecast performance of economists surveyed bi-annually by the *Wall Street Journal.* Although their forecasts generally appear unbiased, neither the consensus forecast nor any economist participating in at least 20 surveys have laudable records, particularly with respect to predicting long-term interest rate or exchange rate movements. We find evidence that predictions of some economists are systematically above the survey mean, while those of others are systematically below. We also find some support for strategic models that predict that the absolute deviations of economists' forecasts from the consensus depend on the industry of the economists' employers. Contrary to previous research, we find that as economists age their forecasts deviate less from the consensus.

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 many of the panel forecast significantly worse than the random walk model, especially when predicting the long-term interest rate. The explanation of this result 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, adopting the random walk forecast 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.

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- Forecasting the Past

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Forecasting the past: the case of US interest rate forecasts

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Abstract This study evaluates 10-year US government bond yield forecasts and three-month US Treasury bill rate forecasts for the period between October 1989 and December 2004. In total, 136 forecast time series with approximately 13,800 forecast data were scrutinized, making this the most extensive analysis of interest rate forecasts to date. Not one of the forecast time series proved to be unbiased. In the majority of cases, information from the past was not efficiently integrated into the forecasts. The sign accuracy is significantly better than random walk forecasts in only a very few of the forecast time series. The modified Diebold–Mariano test for forecast encompassing reveals that the information content of most of the forecast time series is lower than that of the naïve forecasts, the simple ARIMA models, the implicit forward rates, or average interest rate expectations. The forecasting process is dominated by the present and past market situation.

Keywords Interest rate forecasts · Forecast accuracy · US bond market analysts · Topically-orientated trend adjustment behavior

JEL Classification E47 · G12 · G21

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1 Introduction

Forecasts of the future movement of interest rates are fundamentally important to many business decisions, particularly in the banking sector. For example, commercial banks can make a substantial profit on maturity transformations, but such profit is highly dependent on the present and expected future movement of interest rates. Only if reliable interest rate forecasts are available does the risk arising from maturity transformations become manageable.

In the bond market, interest rate forecasts are indispensable to successful portfolio management. Both the proprietary trading and the asset management departments of investment banks thus depend on reliable interest rate forecasts. Additionally, fundamental stock market and exchange rate forecasts are usually based on interest rate forecasts. Research departments use interest rate forecasts as input for further forecasts of the financial market.

Industry relies on interest rate forecasts in deciding the optimal timing of investment. Capital procurement cost in a high interest rate phase can be many times higher than the cost of finance in a low interest rate phase. Also, with regard to the future, medium- and long-term price policies need to take the interest rate into consideration as a cost issue.

As the above brief discussion makes clear, interest rate forecasts play an important role in finance and industry and it is thus of special interest to determine whether and to what extent US companies are capable of making accurate forecasts. This study examines this issue.

Friedman (1980) finds that the interest rate forecasts are biased. Throop (1981) concludes that the forecasts of market professionals are better than those derived from an autoregressive forecasting equation based on the past history of the interest rate. Belongia (1987) shows that interest rate forecasts by analysts are correct about the interest rate trend less than 50% of the time; additionally, these estimates by analysts prove to be inferior to the random walk forecast. Dua (1988) arrives at a mixed result. Depending on the forecast subject, forecast horizon, and forecasting period examined, the forecasts of market experts are partly better and partly worse than a naïve forecast. Simon (1989) shows that analysts forecasts for the Fed funds rate are only marginally better than random walk forecasts. In comparing market expert forecasts with naïve forecasts, Hafer and Hein (1989) establish that depending on the reviewed period of time and the applied forecast error measure, sometimes the naïve forecast is better and sometimes the analysts' forecast is better, but only minimally so in either case. These findings were confirmed in a later study by Hafer et al. (1992).

Domian (1992) argues that money market mutual funds, which are able to forecast interest rates, should lengthen their maturities before a drop in rates, and shorten their maturities before a rise in rates. An examination of the maturity structures of the reviewed funds shows that the fund managers were not able to predict the future movements of interest rates. In a similar study, Francis (1991) examines commercial bank exposure positions. The expectation is that how interest rate risk is managed will reveal the banks' implicit forecast of interest rates; however, the study finds that changes in the risk exposure position are unrelated to later changes of the interest rate. Zarnowitz and Braun (1992) establish that the interest rate forecasts they analyze are superior to those derived by way of an ARIMA model. In a study carried

Table 1 Studies on the accuracy of interest rate forecasts

Study	Evaluated forecast subject	Source of data	Frequency of forecast	Period of time
Friedman (1980)	Rates of Fed funds, 3- and 12-month bills, 6-month Eurodollars, utility bonds, municipal bonds	Goldsmith-Nagan Bond and Money Market Letter	Quarterly	1969–1977
Throop (1981)	3-month US Treasury bill rate	Goldsmith-Nagan Bond and Money Market Letter	Quarterly	1970–1979
Belongia (1987)	3-month US Treasury bill rate	Wall Street Journal	Semi-annual	1981–1986
Dua (1988)	3- and 12-month US Treasury bill rate, federal funds rate, rate on high-grade tax-exempt bonds, rate on Aaa utility bonds	Goldsmith-Nagan Bond and Money Market Letter/Federal Reserve Bulletin/The Bond Buyer	Quarterly	1972–1985
Simon (1989)	Fed funds rate	Money Market Services	Two-weekly	1984–1987
Hafer and Hein (1989)	3-month US Treasury bill rate	Bond and Money Market Letter	Quarterly	1969–1989
Hafer et al. (1992)	3-month US Treasury bill rate	Bond and Money Market Letter/Wall Street Journal	Quarterly and semi-annual	1977–1988
Zarnowitz and Braun (1992)	3-month US Treasury bill rate	ASA-NBER Quarterly Survey	Quarterly	1968–1990
Cho (1996)	3-month US Treasury bill rate and 30-year US government bond yield	Wall Street Journal	Semi-annual	1981–1994
Ilmanen (1996)	3-month US Treasury bill rate and 30-year US government bond yield	Wall Street Journal	Semi-annual	1981–1994
Kolb and Stekler (1996)	3-month US Treasury bill rate and 30-year US government bond yield	Wall Street Journal	Semi-annual	1982–1990
Gosnell and Kolb (1997)	3-month Euromarket rate for US, UK, Germany, Japan, Switzerland	Risk	Monthly	1990–1992
Baghestani et al. (2000)	3-month US Treasury bill rate	ASA-NBER Quarterly Survey	Quarterly	1983–1995

Table 1 (Continued)

Study	Evaluated forecast subject	Source of data	Frequency of forecast	Period of time
Albrecht (2000)	3-month German money market rate and 10-year German government bond yield	Finanzen	Monthly	1991–1997
Spiwoks (2003)	10-year German government bond yield	Consensus Forecasts	Monthly	1989–1999
Greer (2003)	30-year US Government bond yield	Wall Street Journal	Semi-annual	1984–1998
Brooks and Gray (2004)	30-year and 10-year US government bond yield	Wall Street Journal	Semi-annual	1982–2002
Mose (2005)	10-year US and German government bond yield	Consensus Forecasts	Monthly	1989–2005
Baghestani (2005)	3-month US Treasury bill rate	Survey of Professional Forecasters (SPF)	Quarterly	2001–2003
Scheier and Spiwoks (2006)	10-year UK government bond yield	Consensus Forecasts	Monthly	1989–2003
Benke (2006)	10-year German government bond yield	Handelsblatt	Annual	1991–2005
Spiwoks and Hein (2007)	10-year government bond yield for US, UK, Germany, France, Italy, Japan	ZEW-Finanzmarktreport	Monthly	1995–2004

out by Ilmanen (1996), the quality of the interest rate forecasts of market experts was poorer than that of naïve forecasts. Cho (1996), on the other hand, finds that most of the forecast time series analyzed were better than naïve forecasts. Kolb and Stekler (1996) show that interest rate forecasts by market experts are not significantly better than random walk forecasts. Baghestani et al. (2000) establish that the interest rate forecasts they looked at were usually less accurate than the futures market. Greer (2003) concludes that analysts' estimates are better than random walk forecasts; however, Brooks and Gray (2004) and Mose (2005) find exactly the opposite. Baghestani (2005) finds that depending on the forecast horizon and the applied forecast error measure, sometimes the naïve forecast and sometimes the analysts' forecast provide better results.

It is not only US interest rate forecasts that have come under investigation. Gosnell and Kolb (1997), as well as Spiwoks and Hein (2007), analyze interest rate forecasts for the US, Japanese, UK, German, French, Italian, and Swiss money and capital markets. Whereas Gosnell and Kolb's results reveal that the survey forecasts were usually more successful than naïve forecasts, Spiwoks and Hein come to the opposite conclusion.

Albrecht (2000), Spiwoks (2003), Mose (2005), and Benke (2006) show that German banks' predicted future interest rates are less accurate than corresponding naïve forecasts. Scheier and Spiwoks (2006) come to the conclusion that apart from a few exceptional cases, interest rate forecasts for the UK bond market are of lower quality than naïve forecasts.

Although there have been more than a dozen studies on US interest rate forecasts (see Table 1), more work is needed, especially in regard to the following four issues.

1. Examination of the accuracy (or lack thereof) of capital market forecasts is a continuous task, given that considerable changes can result due to changing market conditions, not to mention the further development of analysis methods. More than half the previous studies of US interest rate forecasts are based on forecast data from before 1990. The extent to which these studies reflect the circumstances of the more recent past is questionable.
2. Many of the extant studies restrict themselves to only one or two investigation methods, so that a complete picture is not provided. In particular, the TOTA coefficient has not yet been used on US forecast time series, nor has much use been made of the modified Diebold–Mariano test for forecast encompassing with four fundamental benchmarks.
3. In most of the existing research, the data basis is rather small, either because only annual, semi-annual, or quarterly data were evaluated, or because the time period reviewed is relatively short.
4. The survey results are usually summarized to consensus forecasts, so that only a single forecast time series can be analyzed for each subject of a forecast. There has thus been no differentiated analysis of the forecasting success of the individual survey participants. However, differentiated analyses of this type do exist for forecasts of German (Albrecht 2000; Spiwoks 2003; Benke 2006) and UK (Scheier and Spiwoks 2006) interest rate trends and these analyses not only provide an overview of average forecasting success; they also reveal possible differences between the institutions making the forecasts. To date, only Kolb and Stekler (1996)

and Cho (1996) have presented studies on US interest rate forecasts that break down the results into those of the individual forecaster. However, Kolb and Stekler (1996) studied only 11 forecasters, and the forecast time series they analyzed have only nine values on average. Cho (1996) covers 24 different forecasters, but the forecast time series are fairly short. Cho's time series do have a maximum of 26 values, but he employs a very narrow repertoire of procedures to measure the quality of forecasts.

In this study, we analyzed 136 forecast time series for 10-year US government bond yields and 3-month US Treasury bill rates from 34 banks, insurance companies, financial services companies, research and consulting institutes, associations, and industrial companies. The shortest examined time series is 50 forecast data; the longest 171 forecast data. On average, each of the 136 time series provides 101 forecast data. With its total of 13,798 items of forecast data, this study is by far the most extensive ever made of US interest rate forecasts. Our use of eight procedures to evaluate forecasts permits a differentiated assessment of the performance of US bond market analysts.

The enormous practical significance of interest rate forecasts, particularly for the credit services sector and the investment business, justifies every effort made to examine the reliability of these forecasts in as comprehensive, differentiated, and up-to-date way as possible.

Evaluation of the forecast time series is conducted in Sect. 4 of the paper. The underlying methods are presented in the next section, and the database is described in Sect. 3. Section 5 concludes.

2 Methods

The forecast data are examined with regard to unbiasedness, efficiency, and sign accuracy. With the aid of the modified Diebold–Mariano test for forecast encompassing, the quality of the forecast is compared to four different benchmarks (naïve forecasts, ARIMA models, implicit forward rates, and consensus forecasts). Finally, the TOTA coefficient is used to identify topically-orientated trend adjustment behavior.

The test for unbiasedness examines whether the forecasts correspond to the actual events that occur later. x_t represents the actual event at the moment in time t, $\hat{x}_t$ represents the forecast of this event, and u_t a residual at the moment in time t.

$$x_t = a + b\hat{x}_t + u_t. \tag{1}$$

According to this equation, forecasts are unbiased if a does not significantly differ from 0, b does not significantly differ from 1, and the error term u is not autocorrelated. The first two conditions are verified by way of the F-test and the last by using the Durbin–Watson test. All standard errors are calculated applying the Newey and West (1987) estimation procedure that allows for heteroscedasticity in the error terms. This is indispensable when the forecast horizon is larger than the observational frequency (see Hanson and Hodrick 1980).

The test for efficiency examines whether appropriate consideration has been given to actual events observed prior to a forecast. x_t represents the actual event at the moment in time t, $\hat{x}_t$ represents the forecast of this event, h the forecast horizon, and u_t a residual at the moment in time t.

$$x_t - \hat{x}_t = b_0 + \sum_{i=1}^{4} b_i x_{t-h-i} + u_t. \tag{2}$$

If the information on prior events has been used efficiently, the analysts' forecast errors should not be correlated with the lags. Following the example of Simon (1989), we take the last four actual events into consideration. Whether an existing correlation between the forecast errors and the lag variables can be viewed as significant is determined by way of the F-test.

Sign accuracy is measured by comparing the forecasts with the actual events and then arranging them in a 2×2 contingency table. The forecasts that estimated the direction of interest rate movement correctly (rising or falling) can be found in the main diagonals (N_{11} and N_{22}). The off-diagonals (N_{12} and N_{21}) contain the forecasts that incorrectly estimated the direction of interest rate change. An χ^2 test is then applied to examine whether the distribution frequency of the four fields is significantly different from a random walk forecast (cf. Diebold and Lopez 1996; Joutz and Stekler 2000) and, if so, whether the forecasts examined were significantly better or significantly worse than the random walk forecasts.

In addition, the forecasts should be measured against various benchmarks. Fair and Shiller (1990) show that measuring forecast accuracy on the basis of root mean squared error (RMSE) or Theil's U_2 does not result in reliable deductions about the information content of a forecast time series. Therefore, the modified Diebold–Mariano test for forecast encompassing is applied here to examine whether the analyzed forecast time series have a level of information content that is significantly beyond the benchmark forecast. The initial premise here is that a forecasted situation y_m is described by two competing forecast models i and j:

$$\hat{y}_m = (1 - \lambda)\hat{y}_{i,m} + \lambda \hat{y}_{j,m}, \tag{3}$$

where $0 \leq \lambda \leq 1$. If $\lambda = 0$, then the forecasts generated by model i are said to encompass the forecasts generated by model j, as model j does not contribute any useful information—apart from that already contained in model i—to the formation of an optimal composite forecast. Harvey et al. (1998) develop a statistic to test the null hypothesis that $H_0 : \lambda = 0$ against the alternative that $H_1 : \lambda > 0$. If the null hypothesis is rejected, then the forecasts contain distinct predictive information useful for making an optimal forecast $\hat{y}_m$.

Four different benchmarks are employed to comprehensively evaluate the forecast: (1) the (no change) naïve forecast, (2) a simple ARIMA model, (3) the rate expectations of the capital market in the form of implicit forward rates, and (4) the average rate expectations of capital market analysts (consensus forecasts).

The appropriateness of the ARIMA models was determined with the aid of the AIC criterion. The ARIMA model for the 10-year US government bond yield contains two autoregressive terms, the consideration of the first differences, and two moving average terms. The ARIMA model for the 3-month US Treasury bill rate contains six autoregressive terms, the consideration of the first differences, and six moving average terms.

Calculation of the implicit forward rates is based on the market expectations hypothesis, which suggests that the shape of the yield curve depends on market participants' expectations of future interest rates. Calculation of the implicit forward rates is carried out as follows:

$$i_{gk} = \sqrt[k-g]{\frac{(1+i_{0k})^k}{(1+i_{0g})^g}} - 1, \tag{4}$$

where i_{gk} represents the implicit forward rate of the maturity k–g, i_{0k} represents the current interest rate for the longer maturity k, and i_{0g} represents the current interest rate for the shorter maturity g.

When forecasts are mainly based on the current trend of the variable to be forecast, so that the forecasts correspond to a greater extent with actual events at the time they are issued than they do at the time in the future to which the forecast is directed, this is called topically-orientated trend adjustment behavior (TOTA).

Financial market forecasts are continually adjusted to reflect current market movements and can, in the worst case, completely lose any future-oriented character. Therefore, it is of special interest whether a forecast is marked by topically-orientated trend adjustment behavior. The TOTA coefficient can be used to identify this characteristic. The TOTA coefficient shows whether the forecast data time series reflects actual market movements or whether the forecast data time series instead reflects the time series of naïve forecasts. With the help of the TOTA coefficient, one can determine whether the forecaster orients his or her forecasts toward the future or whether, instead, they are purely reflective of the present market situation.

To calculate the TOTA coefficient (see Bofinger and Schmidt 2003; Andres and Spiwoks 1999), first the coefficient of determination of the forecast data and the actual events are calculated (R_A^2) (Fig. 1). Then the coefficient of determination of the forecast data from the time when forecasts were issued with the actual events is calculated (R_B^2) (Fig. 2).

$$\text{TOTA coefficient} = \frac{R_A^2}{R_B^2} = \frac{R^2_{\text{forecasts; actual}}}{R^2_{\text{forecasts; actual-}h}}. \tag{5}$$

where h is the forecast horizon.

If the TOTA coefficient is <1, a topically-orientated trend adjustment is assumed, meaning that the forecast time series transferred back to the time when the forecasts were made shows a higher correspondence with the actual values than does the forecast time series at the point in the future for which it was forecast. For a TOTA coefficient <1, the forecast time series reflects the present more strongly than the future. Figures 1 and 2 illustrate the TOTA coefficient concept in a way that makes it more intuitively easy to grasp.

3 Data

Bates and Granger (1969) were the first to ask whether better forecast results could be achieved by combining forecasts, based on the idea that each of the existing forecasts contains useful information on future events, and that the merger of these sets of information could boost the accuracy of the forecasts. This theory initiated a lively scientific discussion about the possibilities and limits of combined forecasts, culminating in 1989 with special editions of both the *Journal of Forecasting* and the *International Journal of Forecasting*. In that same year, the company Consensus Economics founded the *Consensus Forecasts* magazine, which has been published monthly ever since October 1989. Local financial service companies, research institutions, and industrial companies provide forecast data for their countries to Consensus Economics. Forecasts are made for important economic values. The consensus forecasts are arrived at by simply averaging the base forecasts. One of the types of forecast Consensus Economics produces is one for interest rates. Not only the mean, but also the single forecasts of the companies and institutions involved are published. These data are the basis of this study.

Forecasts of the 10-year US government bond yield and forecasts of 3-month US Treasury bill rates are evaluated. Consensus Forecasts distinguishes between two forecast horizons: 3 and 12 months. In actuality, however, the forecast horizons are of 4 and 13 months. An example will serve to explain this apparent inconsistency. The September 2001 issue of the *Consensus Forecasts magazine*, which comes out mid-month, contains forecasts for the end of December 2001 and for the end of September 2002. The forecasts were compiled at the beginning of September at the participating institutions. From the beginning of September to the end of December is actually 4 months, and from the beginning of September of the year in question to the end of September of the following year is actually 13 months. As we shall see, this seemingly trivial detail becomes quite significant when it comes to setting a fair criterion for the forecasts.

In this paper, we examine all companies that provided at least 50 interest rate forecasts to Consensus Forecasts. This resulted in a total of 34 companies, among which were banks, insurance companies, and other financial services companies such as US Trust, Northern Trust, Merrill Lynch, Credit Suisse First Boston, J. P. Morgan, Chase Manhattan, Smith Barney, Wells Fargo, Chemical Bank, Continental Bank, Core States Financial Corp./First Union/Wachovia, Mortgage Bankers, Fannie Mae, Metropolitan Life, and Prudential Insurance. Also included are research and consultancy institutes as well as associations such as Interindustry Forecasting at the University of Maryland (Inforum), Research Seminar in Quantitative Economics at the University of Michigan (RSQE), Georgia State University, Oxford Economic Forecasting (OEF), Wharton Econometric Forecasting Associates (WEFA), Conference Board, Standard & Poor's, Regional Financial Association/Economy.com, Consensus Economics, Dun & Bradstreet, Griggs & Santow, National Association of Homebuilders, and the National Association of Manufacturers. Major industrial companies such as General Motors, Ford Motors, Daimler/Chrysler, Amoco, DuPont, and Eaton Corp. also appear as market experts.

The period of time researched is October 1989 to December 2004. The 136 forecast time series contain 13,798 items of data. The shortest examined time series is 50 forecast data; the longest 171 forecast data. On average, each of the 136 time series provides 101 forecast data. Some caution must be exercised, of course, when comparing the forecasting results of individual institutes because it cannot be ruled out that the interest rate trend is simpler to forecast during some periods and more difficult in others. Thus, if some institutes made forecasts in only 50, 60, or 70 of the total of 171 months analyzed, it is conceivable that the specific period for which the forecast is made is decisive to the success or failure of the forecast. A ranking of institutes according to their forecasting success would be appropriate only if all institutes made forecasts for the entire observation period. However, it is still meaningful to evaluate the forecasting data according to institutes, as in this way we can determine which characteristics of the interest rate forecasts are applicable to only a part of the forecast time series and which characteristics occur generally. Such an analysis may also provide a point of departure for an improvement of the forecasting procedures employed.

Another limitation of the study is that there are individual items of data missing in some forecast time series, a situation that can be a particular impediment to using the Durbin–Watson test as a component of the unbiasedness test. Following the lead of Simon (1989), this study does not employ correction procedures, a method (or lack thereof) that has been justified by the findings of Savin and White (1978), and is further reinforced specifically in the case of forecast accuracy by Lim and McKenzie (1998), who establish that "ignoring the missing observations leads to the same qualitative outcome as correctly taking account of the missing observations" (see also Zarnowitz 1984).

4 Empirical results

When interpreting the results of the unbiasedness test, efficiency test, sign accuracy test, and the Diebold–Mariano test for forecast encompassing, a result is considered significant when a significance level of at least 0.95 is attained, which is equivalent to a p-value with a maximum of 0.05.

Determining whether the forecasts are unbiased leads to a critical appreciation of the success of the forecasts (Table 2). The F-test reveals that—without exception—all the forecast time series with a forecast horizon of 13 months are biased. For forecasts of the 10-year US government bond yield with a forecast horizon of 4 months, the F-test reveals bias in 28 out of 34 cases. For forecasts of the 3-month US Treasury bill rate with a forecast horizon of 4 months, the F-test shows bias in 20 out of 34 cases. The results of the Durbin–Watson test are even clearer. In all 136 forecast time series, there is a clear autocorrelation of the residuals u_t. How these autocorrelations occur will be explained below when we examine the TOTA coefficient. The connection postulated in (1) between forecasts and actual events where $E(a) = 0$, $E(b) = 1$, and u_t are randomly distributed residuals obviously does not correspond to reality.

The efficiency tests present a very mixed picture (Table 3). In the forecasts for the 10-year US government bond yield with a forecast horizon of 13 months, the forecasting error reveals a significant correlation with actual past events in 25 out of 34 forecast time series. Available information on the actual development of interest

Table 2 Results of unbiasedness test: p-values for F-test and Durbin–Watson test

Institution	10-year US government bond yield forecasts				3-month US Treasury bill rate forecasts			
	13-month horizon		4-month horizon		13-month horizon		4-month horizon	
	F-test	DW	F-test	DW	F-test	DW	F-test	DW
Consensus Forec.	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
Amoco Corp.	0.000	0.000	0.000	0.000	0.000	0.000	0.019	0.000
Chase Manhattan	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chemical Bank	0.000	0.000	*0.070*	0.000	0.000	0.000	*0.576*	0.000
Conference B.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Continental Bk.	0.000	0.000	*0.061*	0.000	0.000	0.000	*0.094*	0.000
Core/FU/Wacho.	0.000	0.000	0.015	0.000	0.000	0.000	0.000	0.000
CSFB	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Daimler/Chrysler	0.000	0.000	*0.093*	0.000	0.000	0.000	*0.158*	0.000
Dun & Bradstreet	0.000	0.000	0.000	0.000	0.000	0.000	*0.075*	0.000
DuPont	0.000	0.000	0.000	0.000	0.000	0.000	*0.144*	0.000
Eaton Corp.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fannie Mae	0.000	0.000	0.003	0.000	0.000	0.000	0.048	0.000
Ford Motors	0.000	0.000	0.022	0.000	0.000	0.000	0.000	0.000
General Motors	0.000	0.000	0.000	0.000	0.000	0.000	*0.132*	0.000
Georgia State U.	0.000	0.000	0.030	0.000	0.023	0.000	0.001	0.000
Griggs & Santow	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inforum	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000
J. P. Morgan	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Merrill Lynch	0.000	0.000	0.000	0.000	0.000	0.000	*0.356*	0.000
Metropolitan Life	0.000	0.000	*0.116*	0.000	0.000	0.000	*0.103*	0.000
Mortage Bankers	0.000	0.000	*0.119*	0.000	0.031	0.000	*0.352*	0.000
N. A. Homebuild.	0.000	0.000	0.000	0.000	0.002	0.000	*0.834*	0.000
N. A. Manufact.	0.000	0.000	*0.107*	0.000	0.000	0.000	*0.519*	0.000
Northern Trust	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000
OEF	0.000	0.000	0.002	0.000	0.000	0.000	0.009	0.000
Prudential Ins.	0.000	0.000	0.024	0.000	0.000	0.000	0.012	0.000
Regional Fin. A.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RSQE	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
Smith Barney	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000
Standard&Poor's	0.000	0.000	0.000	0.000	0.000	0.000	*0.086*	0.000
US Trust	0.000	0.000	0.000	0.000	0.016	0.000	*0.184*	0.000
WEFA Group	0.000	0.000	0.000	0.000	0.000	0.000	*0.167*	0.000
Wells Fargo	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 3 Results of efficiency test (p-values) and TOTA coefficient

Institution	10-year US government bond yield forecasts				3-month US Treasury bill rate forecasts			
	13-month horizon		4-month horizon		13-month horizon		4-month horizon	
	TOTA	Effic. t.	TOTA	Effic. t.	TOTA	Effic. t.	TOTA	Effic. t.
Consensus Forec.	0.469	0.004	0.832	*0.129*	0.429	0.000	0.935	0.000
Amoco Corp.	0.170	0.000	0.705	*0.119*	0.113	0.000	0.889	0.000
Chase Manhattan	0.095	0.000	0.693	0.003	0.168	0.000	0.921	*0.070*
Chemical Bank	0.000	0.016	0.492	*0.632*	0.066	0.000	0.889	0.030
Conference B.	0.349	0.000	0.723	0.004	0.483	0.000	0.922	0.000
Continental Bk.	0.065	0.000	0.755	0.034	0.231	0.000	0.909	0.010
Core/FU/Wacho.	0.390	0.026	0.817	*0.294*	0.416	0.000	0.931	0.013
CSFB	0.406	0.000	0.898	0.000	0.340	0.000	0.936	0.010
Daimler/Chrysler	0.373	*0.184*	0.817	*0.172*	0.596	*0.109*	0.950	0.000
Dun & Bradstreet	0.137	0.000	0.430	0.000	0.014	0.000	0.800	0.006
DuPont	0.234	*0.092*	0.732	0.018	0.444	0.000	0.918	0.001
Eaton Corp.	0.243	0.000	0.760	*0.058*	0.435	0.000	0.904	0.000
Fannie Mae	0.266	*0.195*	0.649	*0.059*	0.271	0.001	0.912	0.000
Ford Motors	0.497	*0.258*	0.845	0.011	0.443	0.000	0.934	0.035
General Motors	0.616	*0.086*	0.850	0.004	0.378	0.000	0.933	0.000
Georgia State U.	0.219	*0.618*	0.767	*0.468*	0.841	*0.369*	0.987	*0.387*
Griggs & Santow	0.346	0.000	0.802	0.000	0.159	0.000	0.867	0.000
Inforum	0.103	*0.622*	0.672	*0.085*	0.456	*0.056*	0.936	0.009
J. P. Morgan	0.368	0.005	0.761	0.045	0.624	0.026	0.954	*0.210*
Merrill Lynch	0.299	0.000	0.799	*0.192*	0.429	0.000	0.940	*0.051*
Metropolitan Life	0.001	0.004	0.645	*0.426*	0.134	0.000	0.893	0.029
Mortage Bankers	0.183	*0.117*	0.709	*0.353*	0.583	*0.531*	0.953	0.037
N. A. Homebuild.	0.107	0.008	0.724	0.011	0.412	0.230	0.945	0.007
N. A. Manufact.	0.040	0.000	0.684	*0.231*	0.223	0.000	0.892	0.004
Northern Trust	0.586	0.000	0.845	*0.613*	0.572	0.000	0.970	0.005
OEF	0.452	0.000	0.701	*0.982*	0.415	*0.070*	0.937	*0.092*
Prudential Ins.	0.067	*0.188*	0.499	0.002	0.124	0.001	0.848	0.000
Regional Fin. A.	0.405	0.001	0.747	0.000	0.453	0.004	0.971	0.001
RSQE	0.205	0.000	0.779	0.005	0.355	0.036	0.937	*0.086*
Smith Barney	0.266	0.000	0.645	*0.393*	0.189	0.000	0.955	0.038
Standard&Poor's	0.199	0.000	0.770	*0.094*	0.267	0.000	0.920	*0.054*
US Trust	0.239	0.011	0.719	*0.374*	0.542	0.037	0.931	0.004
WEFA Group	0.004	0.000	0.437	0.002	0.104	0.001	0.867	0.003
Wells Fargo	0.214	0.001	0.688	0.003	0.001	0.000	0.838	0.006

rates has therefore not been appropriately taken into consideration in the forecasts in 25 out of 34 cases. In the case of forecasts with a horizon of only 4 months, an inefficient evaluation of information is revealed in 16 out of 34 forecast time series. Forecasts for the 3-month US Treasury bill rate with a forecast horizon of 13 months reveal significant inefficiencies in 28 out of 34 cases; in the corresponding forecasts with a horizon of four months, 27 out of 34 cases indicate a significantly inefficient use of values from the past. All things considered, 96 of the 136 forecast time series (70.6%) inefficiently use information from the very recent past.

The sign accuracy tests also lead to a mixed evaluation of the institutes' forecasting performance (Table 6). In forecasts for the 10-year US government bond yield with a forecast horizon of 13 months, six out of 34 institutes achieve significant success in estimating the direction of interest rate development (rising or falling). However, the forecasts of five institutes were significantly worse than random walk forecasts. The forecasts of the remaining 23 institutes were not significantly different from random walk forecasts. The four-month horizon forecasts are even more sobering: four institutes predicted the trend more poorly than a random walk forecast would have done; the remaining forecast time series do not differ significantly from a random walk forecast. Forecasts for the 3-month US Treasury bill rate with a forecast horizon of 13 months are not much better. Five forecast time series predict the interest rate trend significantly better and two forecast it significantly worse than a random walk forecast. In 27 of the forecast time series, no difference between them and a random walk forecast could be found. A somewhat more favorable picture is revealed by the corresponding forecasts with a 4-month horizon: 16 out of 34 forecast time series (47.1%) predict the interest rate trend significantly better than a random walk forecast. The remaining 18 time series are not significantly different from a random walk forecast. All told, 109 out of 136 forecast time series (80.2%) do not predict interest rate trends any better than a random walk forecast.

The results are very clear with respect to the TOTA coefficient (Table 3). In all 136 forecast time series, there is a topically-orientated trend adjustment, meaning that the forecasts are more accurate at the time they are made than they are at the time for which they are intended to be applicable. The forecasts thus tend to reflect the present (or the very recent past) more than the future. Figures 1 and 2 graphically illustrate this point.

Figure 1 shows the time series of the combined forecasts of Consensus Economics (10-year US government bond yield forecasts with a forecast horizon of 13 months). The figure makes obvious that the forecast time series reflects the actual movement of interest rates very poorly. For example, the forecast for October 1994 predicted a local interest rate low of 5.7%, but,in reality, there was a local interest rate high of 7.9%. For January 1996, a local interest rate high of 7.9% was forecast; in actuality, there was a local interest rate low of 5.6%. Again, in January 2000, the interest rate level is significantly underestimated. While the forecast expects a local interest rate low of 5.0%, a local interest rate high of 6.6% appears. May 2003 provides an absolute interest rate low of 3.4%, whereas the forecast suggests a local interest rate high of 5.7%.

Nonetheless, the forecast time series do have *some* relation to actual interest rates. The forecast time series appear to be a delayed image of the actual interest rate development,that is, the forecast lags behind reality. This is especially apparent when

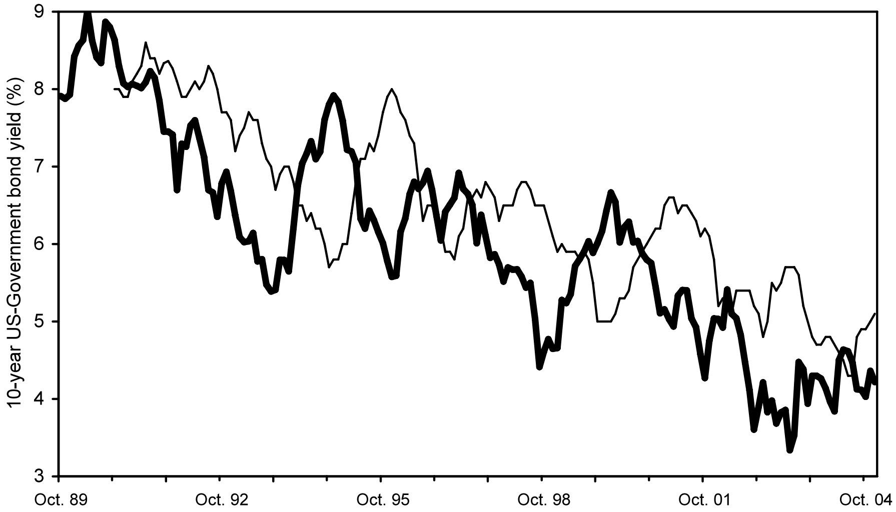

Fig. 1 10-year US government bond yield (*bold line*) and respective forecasts of Consensus Economics with 13-month forecast horizon (*thin line*)

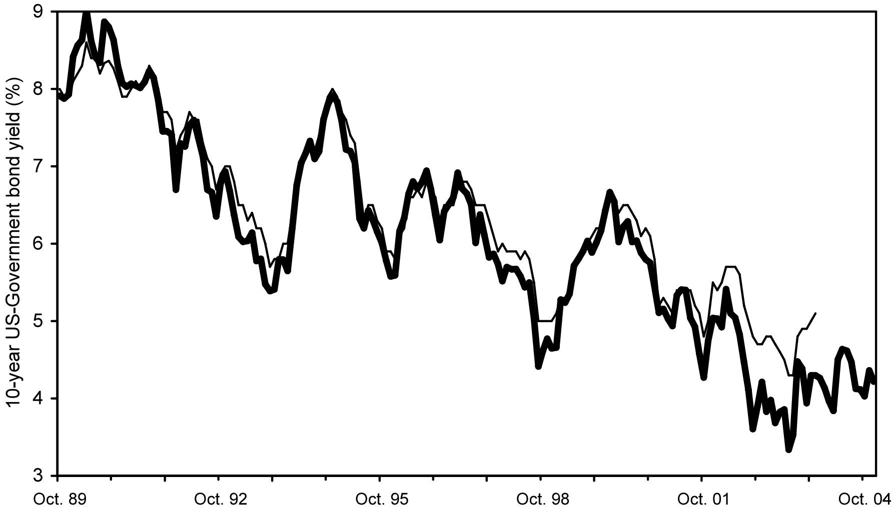

Fig. 2 10-year US government bond yield (*bold line*) and forecasts from Consensus Economics shifted to the left by 13 months (*thin line*)

the forecast data are shifted left by their forecast horizon (13 months), so that the forecasts apply to their issue date, not the date for which they were intended to apply (Fig. 2). This projection reveals that the market experts were highly influenced by the current market situation. Indeed, one could go so far as to say that the experts were actually "forecasting the present." The TOTA coefficient value is 0.469, thus

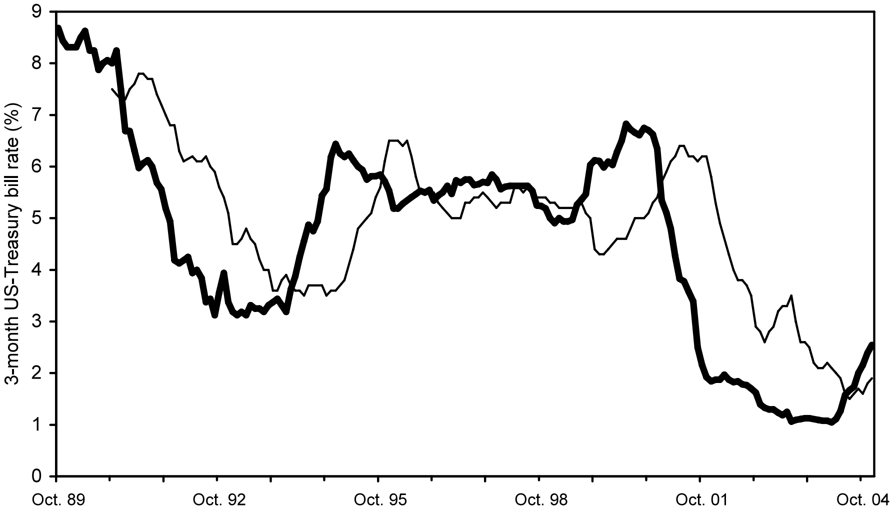

Fig. 3 3-month US Treasury bill rate (*bold line*) and respective forecasts of Consensus Economics with 13-month forecast horizon (*thin line*)

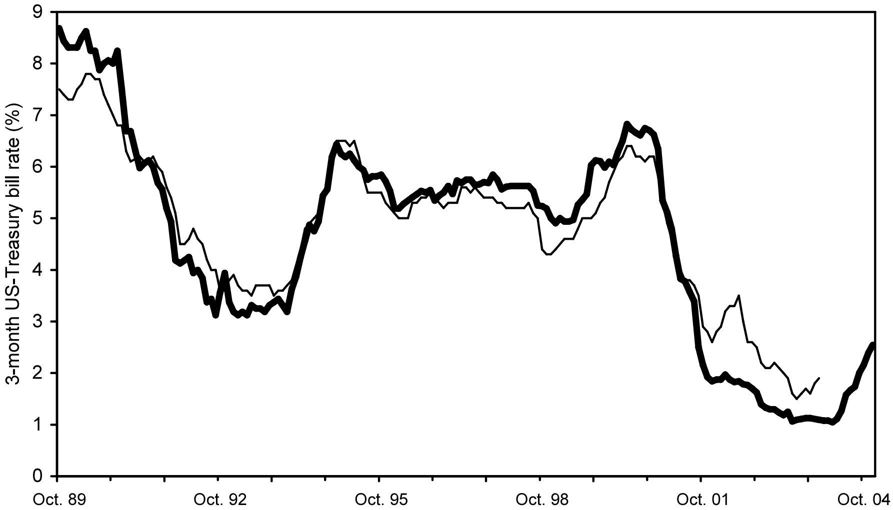

Fig. 4 3-month US Treasury bill rate (*bold line*) and forecasts from Consensus Economics shifted to the left by 13 months (*thin line*)

confirming the topically-orientated trend adjustment. The 3-month US Treasury bill rate forecasts are hardly more successful (see Figs. 3 and 4).

All examined forecast times series have a TOTA coefficient <1. Thus, all 136 cases reflect a topically-orientated trend adjustment. The graphic analysis also shows that the analysts are strongly oriented toward the current or past market situation when they generate their forecasts.

This forecaster behavior also explains why none of the forecast time series are unbiased. When interest rates are rising, there are long periods of underestimation; when rates are falling, there are long periods of overestimation of the actual future interest rate level.

Evidence of topically-orientated trend adjustments in capital market forecasts showed up as early as the late 1980s (Manzur 1988; Allen and Taylor 1990; Takagi 1991), but it is only in the past 5 years that it has become apparent that this could be a general characteristic of capital market forecasts (e.g., Spiwoks 2003; Bofinger and Schmidt 2003; Brooks and Gray 2004; Harrison and Mogford 2004; Scheier and Spiwoks 2006; Spiwoks and Hein 2007). This study offers for the first time comprehensive evidence of the presence of topically-orientated trend adjustments in forecasts for the world's largest and most important bond market, evidence that is sure to intensify further research into this phenomenon.

Theories about what actually causes topically-orientated trend adjustments in capital market forecasts are still in their infancy. Bofinger and Schmidt (2003) consider the anchoring heuristic to be the cause; Spiwoks (2004) works on the assumption that the phenomenon is based on a specific type of rational herding behavior; and other individual psychological and social influence processes are also under consideration as possible causes.

Finally, the modified Diebold–Mariano test for forecast encompassing is conducted (Tables 4 and 5). Here, the forecast time series are compared with four different benchmarks: (1) the (no change) naïve forecast, (2) a simple ARIMA model, (3) the rate expectations of the capital market in the form of implicit forward rates, and (4) the average rate expectations of capital market analysts (consensus forecasts).

For the 10-year US government bond yield forecasts, the four benchmarks paint a very uniform picture. Sixty-two of the 68 forecast time series (91.2%) exhibit an information content that does not go significantly beyond any of the four benchmarks. Three forecast time series beat all four of the benchmarks. Only three of the 68 forecast time series exhibit mixed results, each with regard to only one of the four benchmarks. When applied to this forecast subject, the four benchmarks thus prove to be very comparable. Using only one benchmark would not have led to any appreciable deviations in the results.

The result of the Diebold–Mariano test is somewhat grim. Only three out of 68 forecast time series (4.4%) predict the future interest rate trend significantly better than a naïve forecast, a simple ARIMA model, the implicit forward rates, and the consensus forecast. In 95.6% of the cases, results that are not significantly worse than those made by experts can be achieved with the simplest forecasting approach—a (no change) naïve forecast.

In the case of the 3-month US Treasury bill rate forecasts, however, the four benchmarks prove to be rather varying standards of comparison. With a forecast horizon of 13 months, the naïve forecast, the ARIMA model, and the consensus forecast reveal themselves to be comparatively strict benchmarks. None of the forecast time series has an information content that goes significantly beyond that of the naïve forecast. Two time series exceed the information content of the ARIMA model and four time series exceed that of the consensus forecast. On the other hand, 20 out of the 34 forecast time series (58.8%) exceed the information content of the implicit forward rate.

Table 4 Results of modified Diebold–Mariano test for forecast encompassing (naïve forecasts, ARIMA forecasts, implicit forward rates, mean expectations) of 10-year US government bond yield forecasts (*p*-values)

Institution	13-month forecast horizon				4-month forecast horizon			
	Naïve f.	ARIMA	forw. r.	expect.	naïve f.	ARIMA	forw. r.	expect.
Consensus Forec.	0.417	0.410	0.209	–	0.745	0.638	0.484	–
Amoco Corp.	*0.002*	*0.001*	*0.000*	*0.000*	0.846	0.788	0.651	0.930
Chase Manhattan	0.432	0.489	0.245	0.673	0.607	0.530	0.440	0.704
Chemical Bank	0.309	0.299	0.240	0.511	0.988	0.979	0.973	0.973
Conference B.	0.553	0.777	0.679	0.831	0.838	0.851	0.900	0.973
Continental Bk.	0.760	0.553	0.405	0.914	0.069	0.070	0.057	0.092
Core/FU/Wacho.	0.585	0.557	0.484	0.867	0.426	0.342	0.276	0.273
CSFB	0.120	0.114	*0.026*	0.054	*0.017*	*0.005*	*0.004*	*0.000*
Daimler/Chrysler	0.327	0.330	0.403	0.434	0.349	0.317	0.411	0.168
Dun & Bradstreet	0.666	0.670	0.788	0.888	0.618	0.494	0.509	0.286
DuPont	0.472	0.464	0.620	0.544	0.683	0.654	0.513	0.143
Eaton Corp.	0.822	0.832	0.689	0.663	0.671	0.557	0.421	0.107
Fannie Mae	0.255	0.256	0.269	*0.005*	0.537	0.562	0.588	0.440
Ford Motors	0.241	0.233	0.230	0.551	0.599	0.581	0.384	0.685
General Motors	0.596	0.591	0.417	0.782	0.847	0.894	0.815	0.842
Georgia State U.	0.636	0.510	0.827	0.887	0.792	0.733	0.841	0.927
Griggs & Santow	0.832	0.834	0.848	0.951	0.332	0.217	0.193	0.059
Inforum	0.271	0.270	0.325	0.103	0.352	0.347	0.316	0.351
J. P. Morgan	0.854	0.847	0.975	0.929	0.352	0.347	0.316	0.351
Merrill Lynch	0.788	0.787	0.722	0.936	0.619	0.699	0.575	0.630
Metropolitan Life	0.138	0.135	*0.023*	0.172	0.327	0.252	0.126	0.176
Mortage Bankers	0.749	0.744	0.691	0.435	0.757	0.702	0.749	0.626
N. A. Homebuild.	0.920	0.908	0.948	0.889	0.733	0.638	0.701	0.365
N. A. Manufact.	0.242	0.245	0.128	0.250	0.239	0.189	0.114	0.107
Northern Trust	0.708	0.626	0.367	0.254	0.845	0.680	0.512	0.271
OEF	0.091	0.093	0.102	0.086	0.251	0.204	0.152	0.140
Prudential Ins.	0.318	0.328	0.271	0.284	0.575	0.586	0.609	0.372
Regional Fin. A.	0.557	0.560	0.561	0.833	0.911	0.921	0.934	0.990
RSQE	0.884	0.856	0.733	0.492	0.530	0.465	0.390	0.382
Smith Barney	*0.001*	*0.002*	*0.000*	*0.012*	0.392	0.312	0.202	0.160
Standard&Poor's	0.883	0.886	0.668	0.526	0.938	0.850	0.805	0.624
US Trust	0.361	0.362	0.383	0.132	0.063	0.611	0.662	0.115
WEFA Group	0.585	0.576	0.465	0.853	0.903	0.923	0.834	0.902
Wells Fargo	0.775	0.777	0.953	0.951	0.999	0.999	0.999	0.977

This shows that position taken by some authors (e.g., Schulte et al. 1995; Ilmanen 1996) as to the significance of implicit forward rates is not without foundation.

Table 5 Results of modified Diebold–Mariano test for forecast encompassing (naïve forecasts, ARIMA forecasts, implicit forward rates, mean expectations) of 3-month US Treasury bill rate forecasts (p-values)

Institution	13-month forecast horizon				4-month forecast horizon			
	naïve f.	ARIMA	forw. r.	expect.	naïve f.	ARIMA	forw. r.	expect.
Consensus Forec.	0.262	0.073	*0.004*	–	*0.000*	*0.000*	*0.000*	–
Amoco Corp.	0.457	0.311	*0.008*	0.854	*0.024*	*0.000*	*0.000*	0.790
Chase Manhattan	0.181	0.085	*0.046*	0.386	*0.029*	*0.002*	*0.000*	0.345
Chemical Bank	0.181	0.085	*0.046*	0.386	*0.048*	*0.000*	*0.000*	0.854
Conference B.	0.710	0.583	0.752	0.862	0.314	*0.035*	*0.000*	0.837
Continental Bk.	0.583	0.261	*0.041*	0.750	*0.005*	*0.000*	*0.000*	0.746
Core/FU/Wacho.	0.399	0.112	*0.006*	0.423	*0.000*	*0.000*	*0.000*	*0.033*
CSFB	0.188	*0.023*	*0.017*	0.092	*0.020*	*0.000*	*0.000*	0.223
Daimler/Chrysler	0.422	0.143	*0.005*	*0.015*	*0.005*	*0.000*	*0.000*	*0.030*
Dun & Bradstreet	0.689	0.454	*0.041*	0.742	*0.002*	*0.000*	*0.000*	0.245
DuPont	0.348	0.070	*0.032*	0.211	*0.009*	*0.000*	*0.000*	0.819
Eaton Corp.	0.568	0.212	0.122	0.385	0.335	*0.001*	*0.000*	0.996
Fannie Mae	0.663	0.288	0.510	0.822	0.087	*0.002*	*0.000*	0.627
Ford Motors	0.482	0.231	0.163	0.689	0.053	*0.000*	*0.000*	0.954
General Motors	0.819	0.478	0.164	0.822	0.054	*0.001*	*0.000*	0.737
Georgia State U.	0.631	0.342	*0.017*	0.175	0.939	0.051	*0.000*	0.802
Griggs & Santow	0.855	0.431	*0.002*	0.856	*0.046*	*0.000*	*0.000*	0.582
Inforum	0.416	0.195	0.109	0.095	0.072	*0.026*	*0.000*	0.355
J. P. Morgan	0.312	0.123	0.453	0.284	*0.008*	*0.003*	*0.000*	*0.023*
Merrill Lynch	0.433	0.086	*0.009*	0.190	*0.001*	*0.000*	*0.000*	*0.001*
Metropolitan Life	0.114	0.051	*0.017*	0.082	*0.010*	*0.000*	*0.000*	0.806
Mortage Bankers	0.858	0.794	0.212	0.568	0.078	*0.024*	*0.000*	0.109
N. A. Homebuild.	0.721	0.297	0.226	0.697	*0.007*	*0.001*	*0.000*	0.063
N. A. Manufact.	0.238	0.051	*0.007*	*0.046*	*0.000*	*0.000*	*0.000*	*0.035*
Northern Trust	0.689	0.273	*0.014*	0.687	*0.024*	*0.015*	*0.000*	0.085
OEF	0.746	0.331	0.258	0.161	*0.024*	*0.015*	*0.000*	0.085
Prudential Ins.	0.687	0.469	0.364	0.661	0.121	*0.004*	*0.000*	0.875
Regional Fin. A.	0.933	0.890	0.721	0.968	*0.023*	*0.001*	*0.000*	0.925
RSQE	0.914	0.581	0.551	0.951	*0.003*	*0.000*	*0.000*	0.205
Smith Barney	0.106	*0.038*	*0.002*	*0.019*	*0.006*	*0.000*	*0.000*	*0.013*
Standard&Poor's	0.490	0.105	*0.009*	0.265	*0.000*	*0.000*	*0.000*	0.052
US Trust	0.151	0.067	*0.005*	*0.021*	*0.013*	*0.002*	*0.000*	0.091
WEFA Group	0.446	0.146	*0.016*	0.502	*0.031*	*0.001*	*0.000*	0.597
Wells Fargo	0.357	0.233	0.500	0.953	0.140	*0.002*	*0.000*	0.999

With a forecast horizon of four months, the naïve forecast, the ARIMA model, and the implicit forward rates reveal themselves as not particularly strict benchmarks. Thirty-three out of 34 forecast time series (97.1%) prove to be superior to the ARIMA model. All 34 forecast time series have information content in excess of that supplied

Table 6 Results of sign accuracy test (*p*-values)

Institution	10-year US government bond yield forecasts				3-month US Treasury bill rate forecasts			
	13-month horizon		4-month horizon		13-month horizon		4-month horizon	
	p-val.	result	*p*-val.	result	*p*-val.	result	*p*-val.	result
Consensus Forec.	*0.036*	+	0.116	o	0.155	o	*0.000*	+
Amoco Corp.	*0.001*	+	0.597	o	*0.003*	+	0.067	o
Chase Manhattan	0.448	o	0.620	o	0.333	o	*0.030*	+
Chemical Bank	0.399	o	0.052	o	0.745	o	0.964	o
Conference B.	0.464	o	0.185	o	0.768	o	0.692	o
Continental Bank	0.589	o	0.060	o	0.271	o	*0.048*	+
Core/FU/Wacho.	0.583	o	0.091	o	0.867	o	*0.000*	+
CSFB	0.639	o	0.858	o	*0.020*	+	*0.000*	+
Daimler/Chrysler	0.346	o	0.232	o	*0.005*	+	*0.003*	+
Dun & Bradstreet	0.775	o	0.899	o	0.383	o	*0.002*	+
DuPont	*0.001*	+	0.525	o	0.393	o	0.306	o
Eaton Corp.	0.826	o	0.559	o	0.308	o	0.381	o
Fannie Mae	0.096	o	0.319	o	0.380	o	0.076	o
Ford Motors	*0.005*	–	0.890	o	0.051	o	0.163	o
General Motors	0.391	o	0.585	o	0.636	o	0.212	o
Georgia State U.	0.184	o	0.711	o	0.671	o	*0.010*	+
Griggs & Santow	0.724	o	0.253	o	0.270	o	*0.019*	+
Inforum	0.132	o	0.392	o	0.134	o	0.336	o
J. P. Morgan	0.597	o	0.275	o	0.283	o	0.058	o
Merrill Lynch	0.570	o	0.732	o	0.353	o	*0.046*	+
Metropolitan Life	*0.000*	+	0.730	o	*0.000*	+	*0.022*	+
Mortage Bankers	0.567	o	0.256	o	0.497	o	0.974	o
N. A. Homebuild.	*0.013*	–	*0.007*	–	0.580	o	0.234	o
N. A. Manufact.	*0.012*	–	0.182	o	*0.000*	+	*0.025*	+
Northern Trust	0.949	o	0.239	o	0.066	o	*0.000*	+
OEF	*0.000*	+	0.558	o	0.092	o	0.199	o
Prudential Insur.	0.724	o	0.395	o	0.669	o	0.284	o
Regional Fin. A.	0.135	o	*0.023*	–	0.053	o	0.483	o
RSQE	0.222	o	0.896	o	*0.036*	–	*0.020*	+
Smith Barney	*0.000*	+	0.201	o	0.226	o	*0.000*	+
Standard&Poor's	*0.000*	–	0.461	o	0.351	o	*0.000*	+
US Trust	0.703	o	0.845	o	0.655	o	0.347	o
WEFA Group	0.667	o	*0.014*	–	0.276	o	0.369	o
Wells Fargo	*0.014*	–	*0.000*	–	*0.005*	–	0.964	o

o = not significantly different from a random process; + = significantly better than a random process; − = significantly worse than a random process by the implicit forward rates. The naïve forecast proves to be a somewhat higher hurdle, although 24 of the 34 forecast time series (70.6%) do at least exceed the information content of the naïve forecast.

Overall, 3-month US Treasury bill rate forecasts with a forecast horizon of four months are clearly more successful than the other forecasts. This may be because the Federal Reserve's policy has a considerable effect on interest rate trends for short maturities, and also because it usually indicates how it will act in the near future. So-called Fed watching may therefore have led to the successful forecasts.

This partial success is slightly spoiled by the fact that only six of the 34 forecast time series (17.7%) go significantly beyond the information content of the consensus forecast. However, in view of the fact that the forecast time series are usually very similar to each other (see, e.g., Spiwoks 2004), this result is not surprising.

All things considered, 109 out of 136 forecast time series (80.2%) exhibit an information content that is significantly lower than that of the corresponding naïve forecast. The performance of 98 out of 136 forecast time series (72.1%) is not significantly better than the corresponding ARIMA forecasts. Seventy-seven of 136 forecast time series (56.6%) have a forecast quality that is significantly below that of the implicit forward rates. One-hundred-twenty-two of 136 forecast time series (89.7%) do not go beyond the interest rate expectations of capital market analysts in the form of consensus forecasts.

Unbiasedness, efficiency, sign accuracy, TOTA coefficient, and Diebold–Mariano tests all show interest rate forecasts to be of an unsatisfying quality. The practical consequences of this discovery are extensive. A critical inspection of the maturity transformation volume, as well as a consistent use of known procedures of risk evaluation and limitation, is urgently recommended in light of these results. Active investment strategies in the bond market cannot lead to the desired success, namely, the achievement of systematic surplus yields. As active investment strategies are also relatively expensive, a stringent orientation toward passive investment strategies should be pursued. Finally, industrial companies should not make the timing of real investments dependent on expected (i.e., forecasted) changes in the cost of finance.

5 Conclusion

None of the 136 forecast time series analyzed can be considered unbiased. Additionally, 70.6% inefficiently use information from the very recent past; 80.2% do not forecast the interest rate trend (rising or falling) any better than does a random walk forecast. All forecast time series reveal a clear topically-orientated trend adjustment. They therefore tend to agree more with the present (or with the very recent past) than with the future. Only 6.6% of the forecast time series exhibit an information content that goes significantly beyond that of all four benchmarks (naïve forecasts, ARIMA models, implicit forward rates, and consensus forecasts).

Forecasts for the 10-year US government bond yield were generally wrong, as were those with respect to the 3-month US Treasury bill rate with a forecast horizon of 13 months. Only the short-term (4-month) forecast for the 3-month US Treasury bill rate showed any accuracy.

In summary, forecasts regarding US interest rate trends are extremely unsuccessful. Those who make use of these interest rate forecasts need to be aware of their low level of reliability.

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Article: Do stocks return 10 to 12% on average?

Do stocks return 10 to 12%, on average? No, and that's a dangerous assumption

BENJAMIN FELIX
SPECIAL TO THE GLOBE AND MAIL
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Numerous online financial content creators claim that stocks can be expected to return an average of 10 to 12 per cent a year. This belief is misguided, and can lead to some questionable advice.

Assumptions about expected stock returns can affect how much people decide to save, how they allocate their assets, and how they choose between alternatives such as investing or paying off debt. Small differences in expected returns can make big differences in financial decisions.

Before debunking it, it's important to understand the origin of the idea that stocks return 10 to 12 per cent. Going back to 1950 through 2023, U.S. stocks have delivered a nominal – before inflation – return of 11.32 per cent, as measured by the Fama/French Total U.S. Market Research Index, or 11.43 per cent, as measured by the S&P 500.

For the 20 years ending December, 2023, the total U.S. market returned an annualized 9.81 per cent, and the S&P 500 returned 9.69 per cent. The genesis of those often quoted 10-per-cent or higher returns is easy to see in recent U.S. data.

An important point is that you can't buy groceries with nominal returns; we need to look at real returns. Take the 15 years ending April, 1985, as an example for why this matters: The U.S. stock market returned a nominal annualized 10.58 per cent, but inflation ran at 7.05 per cent. The real return, which is what matters to investors, was tiny.

The real return on U.S. stocks from 1950 through 2023 was 7.63 per cent, and 7.16

per cent for the 20 years ending December, 2023. A real return above 7 per cent is still exceptional, even for the U.S. market. From 1900 through 1950, U.S. stocks returned a real annualized 5.57 per cent.

Context for the difference in returns between these two periods matters. From 1950 through 2023, U.S. stock valuations increased dramatically. Valuations are the closest thing to gravity in financial markets, and high valuations suggest lower expected returns. Looking at history with no context can be misleading.

Some research on U.S. stock returns has suggested that good old-fashioned luck has played a meaningful role. Disasters that could have happened, and have happened to other countries, simply did not take place in the U.S.

Investors learning about the safety of the U.S. market has driven down expected returns, which has resulted in the rising valuations of U.S. stocks. Together, good luck and valuation increases explain about 2 per cent of the historical U.S. equity risk premium for the period 1920 through March, 2020.

The U.S. market has historically been a great place to invest, and it is still an incredible market for many reasons, but that is not a secret. For realized returns to be high in the future, there will need to be more good luck, more rising valuations or some combination – and valuations are already high.

Netting out the 2-per-cent contribution from luck and learning, the real return on U.S. stocks 1920 through 2020 – the period examined by the paper – is 5.28 per cent, a figure much closer to pre-1950 U.S. stock market returns and, as we will see next, global stock returns.

The magnitude of U.S. stock returns has been high enough to be deemed a puzzle, known as the equity premium puzzle. Knowing that the U.S. is an outlier, one of the ways that researchers have tried to resolve the equity premium puzzle is by looking at historical data outside of the U.S. market.

Global real stock returns from 1900 through 2023 were 5.16 per cent annualized. Research drawing on data for 38 developed markets extending as far back as 1890 for some markets uses block bootstrap to simulate developed market returns and finds a median real 5.28 per cent for international stocks and 4.78 per cent for domestic stocks.

That often cited 10-per-cent return for stocks based on the post-1950 period is roughly equivalent to a 7-per-cent real return in the historical data. That is about 2 per cent higher than unbiased estimates of U.S. expected returns, U.S. equity returns before 1950 and global stock returns spanning 1890 through 2023.

At PWL Capital, we have to estimate expected returns to give people financial advice. Our approach starts with the global historical real return from 1900 through 2023, removes the return attributed to valuation changes and then accounts for current valuations.

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I don't want to crush the dreams of people banking on 10-per-cent returns to meet their goals, but counting on returns that match the best historical period for the best performing stock market is likely to lead to bad long-term outcomes.

Benjamin Felix is a portfolio manager and head of research at PWL Capital. He co-hosts the Rational Reminder podcast and has a YouTube channel. He is a CFP® professional and a CFA® charterholder.

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The Utility of Finance

Shlomit Azgad-Tromer* & Eric Talley**

September 2017

PRELIMINARY DRAFT -- DO NOT QUOTE OR CITE WITHOUT PERMISSION

Abstract: Public Utilities Commissions (PUCs) are charged with regulating a utility's rates to prevent monopoly pricing subject to the constraint that the utility's investors earn a rate of return commensurate with that expected by businesses facing similar risks. Although the task of assessing risk-adjusted returns is a staple of modern finance, we know surprisingly little about how well PUCs accomplish their regulatory mandate when judged against standard benchmarks of financial economics. This article analyzes a dozen years' worth of gas and electric rate-setting decisions from PUCs across the United States and Canada, demonstrating empirically that allowed returns on equity diverge significantly and systematically from the predictions of accepted asset pricing methodologies in finance. Our analysis suggests that current regulatory practice more plausibly reflects an amalgam of other non-finance desiderata, including political goals, incentive provision, regulatory capture and lack of financial valuation expertise among regulators. We also present evidence based on a unique field experiment suggesting that training in finance can partially ameliorate the divergence between PUC rate setting and financial methodologies.

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I. Introduction

During the last three decades, a significant transformation has been underway in regulatory areas where time and risk valuation affect legal outcomes: The emergence and growth of the centrality of financial valuation methodologies to inform legal outcomes. While such approaches were generally foreign to legal and regulatory decision-making in the early 1980s, corporate finance now permeates a vast and growing set of doctrinal areas, ranging from securities fraud, to corporate law, to bankruptcy to tax, to mergers and acquisitions.[1]

Among this burgeoning set of applications, the advance of finance into regulation of public utilities was perhaps *particularly* inevitable. Indeed, the challenge of scrutinizing rates of return has long been a key element of utilities regulation, reflecting an expansive conception of necessary state and federal regulatory power over the actions of natural monopolies, often with important economic implications in play.[2] As is well known, the legal governance of public utilities is designed to ensure that the utility provides critical services to the public at reasonable costs, and to protect consumers against bargaining inequalities, informational disadvantage, collusive pricing, and market inefficiency due to the public's dependency on the continuous provision of public necessity. At the same time, for both legal and practical reasons, regulators must also allow utilities' capital providers to recoup a competitive rate of return on their investments. Accordingly, public utility commissions (PUCs) are vested with power to supervise, administer and regulate the economic activities of utilities, all in the name of striking this balance.

A key component of the utilities regulation process thus pertains to the challenge of pegging rates and prices at levels that yield an appropriate risk-adjusted return for utilities' capital investors. This mandate goes back a full century (at least), and is reflected in the oft-repeated edict from the 1923 United States Supreme Court opinion in *Bluefield Waterworks v. Public Service Commission* :

[1] See generally Roberta Romano, *After the Revolution in Corporate Law*, 55(3) JOURNAL OF LEGAL EDUCATION (September 2005). For specific doctrinal applications of outside of the utilities regulation context, see Kenneth Ayotte & Edward Morrison, "Valuation Disputes in Corporate Bankruptcy" (applying to bankruptcy proceedings) (unpublished manuscript, 2017); Eric Talley, "Finance in the Courtroom: Appraising Its Growing Pains," DELAWARE LAWYER 16 (applying to corporate and shareholder appraisal proceedings) (August 2017).

[2] William J. Novak, *The Public Utility Idea and the Origins of Modern Business Regulation*, in CORPORATIONS AND AMERICAN DEMOCRACY 139-159 (Naomi R. Lamoreaux and Willian J. Novak, eds., 2017).

> A public utility is entitled to such rates as will permit it to earn a return on the value of the property which it employs for the convenience of the public equal to that generally being made at the same time and in the same general part of the country on investments in other business undertakings which are attended by corresponding risks and uncertainties, but it has no constitutional right to such profits as are realized or anticipated in highly profitable enterprises or speculative ventures.[3]

It was not until decades after *Bluefield*, however, that advances in financial economics made it practically possible to address the above mandate formally, using a variety of asset-pricing methodologies. A prime example of such methodological approaches is the Capital Asset Pricing Model—or CAPM—one of a host of now well-accepted approaches for determining how to adjust expected rates of return for anticipated risks.[4]

Yet, to what extent do rate regulators render decisions that comport with standard financial methodology in their decision-making process? This paper offers an empirical analysis of rate awarded by public utility commissions (PUCs), evaluating their relationship to factors that standard finance theory predicts would drive expected returns for capital investors. We analyze data of nearly a thousand PUCs gas and electric rate-setting decisions over a twelve-year period (2005-2016) emanating from PUCs across the United States and Canada. Our benchmark for analysis is the lens of accepted asset-pricing theories from financial economics. We inquire whether awarded rates of return for public utilities are set in a manner consistent with calibrating awarded returns against investment risk. In particular, we assess whether awarded rates of return track those prescribed for individual utilities according to the CAPM, the still-dominant model for quantifying risk and translating it to assessment of expected returns of equity.[5]

Our analysis strongly rejects the hypothesis above with significant confidence: specifically, we demonstrate that rate setting practices diverge appreciably from the predictions of financial economics across numerous dimensions. For example, awarded gross returns on equity (ROEs) tend to exhibit considerable stickiness around focal "odometer" points (particularly a flat 10%) regardless of the cyclical structure of other prevailing benchmark rates.

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[3] Bluefield Waterworks v. Public Service Comm'n, 262 U.S. 679 (1923). Accord FPC v. Hope Natural Gas Company, 320 U.S. 591 (1944) ("The return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital").

[4] DAVID G. LUENBERGER, INVESTMENT SCIENCE (1998).

[5] IVO WELCH, THE CAPITAL ASSET PRICING MODEL, IN CORPORATE FINANCE, Chapter 10, 213 (2017).

Moreover, awarded ROE spreads over risk free treasuries have progressively *widened* significantly since 2005, even though systematic risk in the utilities industry has *fallen continuously* during the same period. Indeed, if the awarded ROEs were an asset class, they would generate a mean positive abnormal return ("alpha") of *between 7.5 and 8.5 percent*, an amount that overshadows even the performance of Fortune Magazine's top twenty stock investments for the last decade.[6] Finally, as anticipated market returns (i.e., systematic risk) have fluctuated during the period studied, awarded ROE spreads have consistently (and curiously) moved in the *opposite* direction, notwithstanding the fact that market returns on utilities' equity overwhelmingly have positive betas. Our analysis thus confidently rejects the hypothesis that awarded ROEs behave anywhere near what finance theory predicts would be the expected return of a commensurably risky investment.

What, then, explains the extreme deviation from standard finance theory's predictions? Although we cannot make definitive conclusions here, we tentatively identify a host of factors that may be at play, including the possibility that regulators' behavior reflects political patronage concerns, dynamic incentive provision, regulatory capture, and a simple lack of expertise in finance. We find, for example, evidence that the structural composition of the PUC is reflected in awarded ROEs: the percent of the commission that is elected predicts lower awarded ROEs, with completely elected commission tending to award significantly *lower* returns on equity (over 100 BPs lower) than completely appointed ones. This effect arguably represents the electoral costs that commissioners pay with rate payers when they rates too high, and/or the greater impediments to long term incentive provision and/or regulatory capture among elected commissions. (Neither elected nor appointed commissions, however, issue rates that comport particularly well with the CAPM.)

Higher awarded rates may also aim to sustain an equity cushion designed to improve utilities' incentives for reliability (and possibly safety).[7] "Inventorying" power is still beyond the capacity of most generators. Sustaining the continuous and uninterrupted electricity service therefore requires maintenance of continuous and almost instantaneous balance between

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[6] See Reviewing Fortune's 20 'Best Investments' Of The Last Decade, Seeking Alpha (9/22/2016, available at https://seekingalpha.com/article/4007867-reviewing-fortunes-20-best-investments-last-decade) (a gross annualized return of 8.1%).

[7] Paul Joskow and Jean Tirole, *Reliability and Competitive Electricity Markets*, 38(1) RAND JOURNAL OF ECONOMICS 60-84, 78 (2007).

production and consumption of electricity in power systems.[8] On certain occasions (such as the Super Bowl), utilities can expect the spike in demand, but not all spikes and dips can be foreseen. To mitigate the risk of power shortages and blackouts, some margin of excess generation capacity above the expected demand load must be kept at all times. Higher awarded rates can sustain investments in excess capacity and may theoretically enhance the reliability of energy provision in the light of the volatility of capital expenditures and the lack of technical storage feasibility.

Another hypothesis is that regulators aim to sustain the financial stability of utilities via rate making, so as to reduce the likelihood of a bailout or a subsidy following financial distress. As utilities are "too important to fail SINFIs, exclusively providing social necessities,[9] rate regulation may implicitly function as micro-prudential regulation for public utilities, using the equity cushion to mitigate the risk of insolvency and illiquidity. The prioritization of such other goals may provide a cogent account for why PUCs appear to veer so far from accurate calibration of risk-adjusted returns.

Alternatively, regulators may place significant weight on the consistency and predictability of awarded rates, independent of systematic risk dynamics. Indeed, the dominant approach for risk-return calibration among regulators tends not to be CAPM, but rather a simplified application of the Gordon dividend growth model (often referred to by regulators—somewhat misleadingly—as the Discounted Cash Flow or "DCF" approach[10]). This methodology—which is specifically endorsed by FERC and many other state regulators, has substantially fewer moving parts than CAPM (limited generally to price, expected dividends and perpetuity growth rates). Consequently, before submitting a request for a rate increase, a utility may be better able to predict the outcome with greater certainty, allowing it to plan its rate increase requests strategically (e.g. to avoid requests during a sensitive election cycle or

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[8] Jose Fernando Prada, *The Value of Reliability in Power Systems – Pricing Operating Reserves* (Massachusetts Institute of Technology, Energy Laboratory, Working Paper, 1999); RICHARD BROWN, ELECTRIC POWER DISTRIBUTION 15, 143 (2009).

[9] Shlomit Azgad-Tromer, *Too Important to Fail: Bankruptcy versus Bailout of Socially Important Non-Financial Institutions*, 7(1) HARVARD BUSINESS LAW REVIEW 160 (2017).

[10] To non-utilities-oriented finance professionals, DCF analysis refers to the estimation of fair-market value for an entire company or its equity, a task that rates of rates of return (however computed) as inputs. As used among utilities regulators, however, DCF means something different, and describes the practice of imputing risk-adjusted returns from observed prices using the Gordon dividend growth model.

economic downturns). Through delivering a more predictable result, however, the (so-called) DCF approach can often diverge from CAPM (and other more foundational asset pricing models), a factor that may permit regulators to commit credibly to stable investment returns ex-ante (even if inconsistent with their putative regulatory mandate)..[11]

A final hypothesis that could be driving *at least part* of the behavior we observe is that risk valuation can place appreciable technical demands on regulators and staffs that are outside their areas of expertise. To the extent an expertise gap exists, it may be addressable through greater financial economics training of commissioners and regulatory staffs. To test this conjecture, we exploit data from a unique field experiment that exposed state-level PUC commissioners and staffs to immersion training in asset pricing and finance (and particularly the CAPM). We find evidence that among treated PUCs, finance training *does* appear to dampen the divergence between post-training rate setting and the predictions of finance. The effects are relatively modest, however, perhaps due to the limited (one day) nature of the training program. Nevertheless, our findings suggest that at least some of the behavior we observe is due to a lack of expertise among decision makers, and that it may be possible to address that expertise gap programmatically. .

Our analysis proceeds as follows. In Section II, we provide a high-level overview of the rate-setting process, and its criticality to utility profitability and solvency. There we provide a brief overview of some details in formulating the weighted average cost of capital, an all-things-considered rate of return that combines tax rates, leverage levels, returns on debt and the all-important return on equity (ROE). We demonstrate how critical (and contentious) ROE determinations are to the overall process, and describe prevailing methodologies used by PUCs to set it. Section III describes our data and presents a series of tests of hypothesis that ROE

[11] Identified by Coase in 1972, the commitment problems and time-inconsistency reflect the risk of under-investment due to uncertainty. When rates are regulated, investors risk the possibility that the regulator would adjudicate a lower rate of return after the investments are absorbed in the corporation or project, expropriating their sunk investments. The expected equilibrium is under-investment, resulting in imminent public infrastructure meltdowns due to backed up maintenance and repair. Predictable rate setting methodology allows the regulator to commit to a fair return on irreversible investments ex ante. Ronald H. Coase, *Durability and Monopoly*, 15 JOURNAL OF LAW AND ECONOMICS 143 (1972); Glenn Blackmon and Richard Zeckhauser, *Fragile Commitments and the Regulatory Process*, 9 YALE JOURNAL ON REGULATION 73 (1992); David P. Baron and David Besanko, *Commitment and Fairness in a Dynamic Regulatory Relationship*, 54 REVIEW OF ECONOMIC STUDIES 413-436 (1987); Gregory Lewis and Patrick Bajari, *Moral Hazard, Incentive Contracts and Risk: Evidence from Procurement*, 81 REVIEW OF ECONOMICS STUDIES, 1201-1228 (2014).

determinations mimic the pricing of risk, all of which are rejected. There we also explore other empirical factors that have some predictive power, and demonstrate the effect of finance training in substantially counteracting the inconsistencies between rate setting and asset pricing predictions. Section IV concludes.

II. Overview of the Regulatory Rate-Setting Process

Public utilities are widely considered natural monopolies, and regulation is designed to mitigate the potential welfare costs of market power, so that monopoly prices do not transfer greater than normal economic rents the consumers to the stockholders of the firm.[12] The welfare loss from the self-rationed production of the monopoly is often called "the deadweight costs" of monopoly, as some consumers who would have purchased at the competitive price are restricted from purchase, resulting in welfare loss.[13] Vulnerability to the exercise of market power is the primary justification for rate regulation.[14] While monopoly power can always visit deadweight losses on any market, the energy sector carries significant negative externalities with distributional consequences. Because utilities provide public necessities, and can be conceptualized as geographical franchises for energy provision, consumers' disadvantage, imposition, unreasonable charges, harmful prices, and harmful standards of service are also well recognized regulatory concerns.[15]

Prices and rates charged by electric and gas utilities are regulated in the United States by targeting (either explicitly or implicitly) market rate of return for a utility's investors (and particularly its equity holders).[16] The authority for rate regulation is divided between the federal government and the states, in which Federal Energy Regulatory Commission (FERC) holds the

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[12] See Richard A. Posner, *The Social Costs of Monopoly and Regulation*, 83 J. POL. ECON. 807, 810 (1975); Gordon Tullock, *The Welfare Costs of Tariffs, monopolies and Theft*, 5 W. ECON. J. 224, 225-26 (1967).
[13] *Id.*
[14] Severin Borenstein, *The Trouble With Electricity Markets: Understanding California's Restructuring Disaster*, 16(1) THE JOURNAL OF ECONOMIC PERSPECTIVES 191-211 (2002); Erin T. Mansur, Pricing Behavior in the Initial Sumer of the Restructured PJM Wholesale Electricity Market. 90(2) THE REVIEW OF ECONOMIC AND STATISTICS 369-386 (2008); Ali Hortacsu and Steven L. Puller, *Understanding Strategic Bidding in Multi-Unit Auctions: A Case Study of the Texas Electricity Spot Market*, 39(1) THE RAND JOURNAL OF ECONOMICS 86-114 (2008).
[15] See William J. Novak, supra note 2 id, at 158-159, arguing that "Monopoly was just one of many other important factors driving the public utility idea".
[16] IRSTON R. BARNES, THE ECONOMICS OF PUBLIC UTILITY REGULATION (1942). Rate-making is a kind of price-fixing: see Munn v. Illinois, 94 U.S. 3, 134 (1877).

jurisdiction over the interstate aspects of power and electricity, while the states largely retain jurisdiction for intrastate matters, including, most notably, retail sale[17.] There are therefore two arenas for rate-setting cases: (a) the FERC for utilities providing interstate power infrastructure; and (b) the state-based public utility commissions for utilities providing retail intrastate power service. In either case, however, a foundational principle that guides regulation of rates in both jurisdictions is that prices should reflect the "cost of service"[18] adjusted to deliver a fair, risk-adjusted rate of return for capital investors.

Consequently, regulators are required to deduce/compute the utility's rate of return, which is typically embodied in the utility's Weighted Average Cost of Capital (WACC)—essentially a tax-adjusted weighted average cost of debt and the expected return of preferred and common stock that a utility has issued to finance its investments. For a utility with a single class of debt and a single class of equity, the WACC is expressed as follows:

$$\mathrm{WACC} = \left(\frac{Debt}{Debt + Equity}\right) \cdot (1-\tau) \cdot \mathrm{ROD} + \left(\frac{Equity}{Debt + Equity}\right) \cdot \mathrm{ROE}, \tag{1}$$

where *Debt* and *Equity* denote the fair market value of the utility's outstanding debt and equity ownership claims, τ denotes the utility's marginal tax rate, and *ROD* and *ROE* denote the returns on debt and equity (respectively) demanded by capital investors. (The inclusion of the $(1-\tau)$ term on the debt component reflects the fact that interest payments are made on a pre-tax basis, and thus are partially subsidized by the tax authorities.)

In computing the WACC, market values for debt and equity, as well as the utility's marginal tax rate are generally straightforward to observe.[19] The return on debt is similarly often straightforward, since the utilities debt instruments / lines of credit specifically note it. But how much should electric and gas utility stockholders earn? The somewhat unhelpful statutory

[17] See Federal Power Commission v. South Cal. Edison Co., 376 U.S. 205, 215-16 (1964); Miss. Power & Light Co. v. Mississippi ex rel. Moore, 487 U.S. 354, 388 (1988); FERC v. Electric Power Supply Association, 136 S. Ct. 760 (2016).

[18] I.A. KAHN, THE ECONOMICS OF REGULATION 26-27 (1970); Dr. Karl McDermott, Cost of Service Regulation in the Investor-Owned Electric Utility Industry: A History of Adaptation, Edison Electric Institute Working Paper (June 2012).

[19] One caveat is that many utilities operate as subsidiaries of larger (often inter-state) utilities, a factor that can complicate both our and regulators' analysis, as discussed below. In such cases, apportioning market values of debt and equity between affiliates can be difficult.

standard running as a scarlet thread throughout energy legislation determines the rates charged by a utility provider should be "just and reasonable"[20]. But what exactly does that mean?

As interpreted by the Supreme Court, the fixing of "just and reasonable" rates involves assessing a return on equity as will permit the utility's equity investors to earn a return commensurate with investors in comparators that face corresponding risks and uncertainties[21]. A "just and reasonable" rate should be reasonably sufficient to assure confidence in the financial soundness of the utility, and should be adequate to maintain and support its credit and enable it to raise the money necessary for its continued operation[22]. Investors' confidence and capital attractiveness are particularly salient for utilities because utilities in financial distress are likely to be sponsored, subsidized or bailed-out by taxpayers due to their unique position as situational monopolies providing of essential services.[23] An operating failure of the public utility, whether due to illiquidity, insolvency, or simple shortage of power supply, is expected to induce a public crisis of confidence, as the social and economic infrastructure of our lives is a based on an implied assumption of continuous and uninterrupted electricity provision.

The statutory mandate to regulate a public utility's ROEs to a just and reasonable level leaves rate regulators in somewhat of a methodological No Man's Land. State public utility commissions are generally free to establish their own methodologies in rate setting procedures. Perhaps due to its ease of use and comprehension by regulators not necessarily particularly vested in financial theories, the most popular method used to determine the ROE among state

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[20] Under the Federal Power Act all rates and charges made, demanded, or received by any public utility for or in connection with interstate wholesale sales shall be "just and reasonable"; so too all rules and regulations affecting or pertaining to such rates or charges: 16 U.S.C.S. § 824(b)(1); 16 U.S. C.S. § 824d(a). If the FERC sees a violation of that standard, it must determine the just and reasonable rate and impose it by order: 16 U.S.C.S. § 824e(a). Similarly, many state public utility statues contain provisions permitting commission authorizations to regulate "just and reasonable rates". See for example AL Code § 37-1-80 (2013) requiring that "the rates for the services rendered and required shall be reasonable and just to both the utility and the public. Every utility shall be entitled to such just and reasonable rates as will enable it at all times to fully perform its duties to the public, and will, under honest, efficient and economical management, earn a fair net return on the reasonable value of its property devoted to the public's service".

[21] Bluefield Water Works & Improvement Company v. Public Service Commission of the State of West Virginia et al., 262 U.S. 679 (1922), reasoning that "Rates which ae not sufficient to yield a reasonable return on the value of the property used… are unjust, unreasonable and confiscatory, and their enforcement deprives the public utility company of its property, in violation of the Fourteenth Amendment".

[22] *Id*, p. 692.

[23] Shlomit Azgad-Tromer, Too Important to Fail, supra note 9 id.

public utility commissions is what they (but few others) refer to as the discounted cash-flow (DCF) approach,[24] which is a variant on the Gordon Dividend-Growth model and conceives of the price of a stock to be present discounted value of its future perpetual dividend stream. The FERC has officially adopted a variant of the DCF as its preferred method for ROE computation (setting a benchmark that is emulated loosely by many state regulators[25]). This approach is based on an underlying premise that an equity investment is worth the present discounted value of its future stream of dividends, discounted at the appropriate risk-adjusted rate, as reflected in the "growing perpetuity" expression:[26]

$$P_0 = \frac{D}{\mathrm{ROE} - \mathrm{E(g)}}, \tag{2}$$

where P_0 is the observed price of the common stock during the regulatory testing period, D is the current dividend, and $\mathrm{E(g)}$ is the expected perpetual growth rate of dividends.

Rearranged to solve for the required rate of return, the ROE can be expressed as:

$$\mathrm{ROE} = \frac{D}{P_0} + \mathrm{E(g)}. \tag{3}$$

Under the FERC's approach, this expression is slightly modified to read:

$$\mathrm{ROE} = \frac{D \cdot (1 + \theta \cdot \mathrm{E(g)})}{P_0} + \mathrm{E(g)}, \tag{3'}$$

where θ is an adjustment factor intended to approximate the effect of the periodicity of "lumpy" dividend payments.[27] As many of the utility providers are public corporations, the price of their common stock and their dividend yield component are in the public domain[28].

[24] Kenneth Gordon and Jeff D. Makholm, *Allowed Return on Equity in Canada and the United States: An Economic, Financial and Institutional Analysis*, NERA Economic Consulting Working Paper 20 (2008). It bears noting that what the PUC utilities community refers to as a DCF approach is somewhat more specialized than what finance practitoners think of it as entailing. Because this paper is about utilities regulation, however, we adhere to that industry's nomenclature.

[25] [Cite]

[26] The FERC has adopted DCF as its main methodology for analyses of required rate of return in the 1970's. See, e.g., Minn. Power and Light Co., 3 FERC 61,045 at 61, 132-22 (1978).

[27] Under the FERC's approach, θ is pegged at 0.5, so that the dividend yield is multiplied by the expression (1+.5E(g)), an adjustment meant to account (somewhat imprecisely) for the fact that dividends are usually paid on a quarterly basis. Multiplying the dividend yield in this manner results in what the FERC refers to as the "adjusted dividend yield". See Massachusetts Attorney General et al. v. Bangor Hydro-Electric Company et al., 147 FERC 61, 234 (2014).

To compute the constant dividend growth rate *E(g)*, the FERC uses a two-step procedure, averaging short-term and long-term growth estimates.[29] The Institutional Brokers Estimate System (IBES)'s five-year forecast for each company in the proxy group, is used to determine the expected growth for the short term[30]. The long-term growth rate—which is almost always lower—is based on forecasts of long-term growth of the economy as a whole, as reflected in GDP: public utilities are assumed to sustain long term growth consistent with the growth of the economy as a whole.[31] The practice endorsed by the FERC to compute the anticipated perpetuity growth rate is to accord the short-term forecast receives a two-thirds weighting and the long-term forecast receives a one-third weighting.[32] We note that when (i) the short-term rate exceeds the long-term rate (as it often does), and (ii) the long term rate is pegged around the expected long-term growth rate for the entire economy (as it usually is), the aggregated perpetuity growth rate under FERC's approach will also exceed the long-term growth rate for the entire economy. Although such assumptions lead to absurd results,[33] utilities regulators have long retained them.

The two-step DCF methodology is purportedly used by the FERC to establish a "zone of reasonableness" for ROEs. Yet, an ROE may be both within the realm of reasonableness and be considered unjust and unreasonable: in other words, not all ROEs within the purported "zone" are truly just and reasonable[34]. To inform the just and reasonable placement of the ROE within the zone of reasonableness, the FERC uses a variety of alternative risk-pricing approaches, such

[28] For the dividend yield component, the FERC uses a single, average dividend yield based on the indicated dividend and the average of the monthly high and low stock prices over a six-month period. See e.g., *Portland Natural Gas Transmission Sys*., Opinion No. 510, 13 FERC 61, 129, at pp 232-234 (2011).

[29] Massachusetts Attorney General et al. v. Bangor Hydro-Electric Company et al, supra note 27 *id*, p. 10.

[30] Earnings forecasts made by investment analysts are considered the best estimate of short-term dividend growth because they are likely relied on by investors when making their investment decisions. See Transcon. Gas Pipe Line Corp., Opinion No. 414-B, 85 FERC 61, 323, at 62,269 & n. 34 (1998).

[31] Opinion No. 396-B, 79 FERC at 62, 382-82; Opinion No, 396-C, 81 FERC 61, 036 (1997), cited at Massachusetts Attorney General et al. v. Bangor Hydro-Electric Company et al, supra note 27 *id*, p. 12. Up until the Bangor Hydro opinion in 2014, the FERC used a one-step DCF methodology for utility providers, which lacked a long-term growth projection.

[32] "Given the greater reliability of the short term projection, we believe it is appropriate to give it greater weight" – see Opinion No. 414-A, 84 FERC at 61, 423-24. The United States Court of Appeals for the District of Columbia Circuit (D.C. Circuit) affirmed this two thirds/one third weighting for determine the overall dividend growth estimate at CAPP v. FERC, 254 F. 3d at 297 (2001).

[33] As several commentators point out, if an assumed perpetuity growth rate for the company exceeds the long term growth rate of the economy, then in the limit the company will eventually come to dominate the entire economy. See, e.g., R. Scott Widen, *Delaware Law, Financial Theory and Investment Banking Valuation Practice*, 4 NYU Journal of Law and Business 578 (2010).

[34] Association of Business Advocating Tariff Equity et al. v. Midcontinent Independent System et al., 156 FERC 61060, 8 (2016); So. Cal. Edison v. FERC, 717 F. 3d at 181-82 (2013).

as the CAPM (discussed below), risk-premium buildup benchmarking, and expected earnings analysis[35]. In addition, record evidence of state commission-approved ROEs is taken into account, and although not used directly to establish utilities' ROEs[36], state commission ROEs do serve as an indicator for an adjustment within the zone of reasonableness to satisfy the level sufficient to attract investment[37].

Although evidently well accepted among utilities regulators, for a variety of reasons (some noted above), the so-called DCF approach is not widely followed by financial professionals outside of the utilities context, the academic literature, or many other legal actors charged with risk pricing. For example, most recent Delaware courts opinions in appraisal matters underlying fairness opinions[38] rely much more centrally on the Capital Asset Pricing Model (CAPM)[39] or (to a lesser extent) the Fama-French three-factor model[40] as the preferred methods for estimation of the company's cost of capital[41]. The popularity of CAPM with finance professionals is based on its assessment of the relationship of investments with risk[42]. The basic intuition that underlies CAPM is that returns and risk go together like a horse and carriage:

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[35] ROGER A. MORIN, NEW REGULATORY FINANCE 108 (2006). Interestingly, utilities regulators have not generally attempted to impute rates of return through comparable company / transaction analysis.

[36] "State commission ROEs are established at different times in different jurisdictions which use different policies, standards and methodologies in setting rates" – see Middle South Services, Inc., Opinion No. 12, 16 FERC 61,101, at 61,221 (1981); see also: Boston Edison Co., Opinion No. 411, 77 FERC 61,272 at 62,171-62,172 (1996): ; Jersey Cent. Power & Light Co., Opinion No. 408, 77 FERC at 61, 002.

[37] Bangor Hydro-Electric Company et al, supra note 27 *id*, p 72: "we are faced with circumstances under which the midpoint of the zone of reasonableness established… has fallen below state commission approved ROEs, even though transmission entails unique risks that state-regulated electric distribution does not… the discrepancy between state ROEs and the… midpoint serves as an indicator that an upward adjustment is necessary to satisfy *Hope* and *Bluefield*".

[38] Under 8.Del.C. § 262(h), upon finding that a stockholder is entitled to an appraisal, the court must determine the fair value of the shares exclusive of any element of value arising from the accomplishment of the proposed transaction. R. Scott Widen, *Delaware Law, Financial Theory and Investment Banking Valuation Practice*, 4 NYU Journal of Law and Business 578 (2010); Gaurav Jetley and Xinyu Ji, *Appraisal Arbitrage – Is There a Delaware Advantage?* 71 The Business Lawyer 427 (2016).

[39] See TIM KOTLER, MARC GOEDHART AND DAVID WESSELS, VALUATION 293-315 (2005). Formulaically, the CAPM posits that an asset's expected return, $E(R_A)$ is given by the expression: $E(R_A) = r_f + \beta_A \cdot (\mathrm{E}(R_M) - r_f)$, where r_f denotes the risk free rate, $\mathrm{E}(R_M)$ denotes the expected return on the market portfolio, and β_A is the asset's "beta" – a measure of risk relative to the market.

[40] Widen notes that the Fama-French model has been used by Delaware Courts in addition to, or instead of, CAPM (p. 582), supra note 38 *id*. The Fama-French model expands on CAPM by adding size and value factors to the market risk factor in CAPM.

[41] Jetley and Ji, *id.*

[42] See IVO WELCH, CORPORATE FINANCE, supra note 5 *id*, at 215, 227 stating that "everyone uses it", citing research showing that 73% of CFOs reported that they "always or almost always use the CAPM", and concluding that "It is literally the dominant, if not only, widely used model to estimate the cost of capital".

CAPM provides a method for quantifying the stock's risk and its expected influence on the expected return for investors.[43] According to the CAPM, the key to assessing the value of a security is to assess the response of the returns of this security to the returns on the market index. The beta coefficient, β, is defined as the sensitivity of the return of that security to the return of the "market" portfolio.

When valuing businesses, the Delaware courts strongly prefer the CAPM (or similar models) for determining risk-adjusted discount rates. However, once that rate is determined, something akin to the dividend-growth model is frequently applied to predict the company's "terminal" value as a stream of cash flows growing consistently in perpetuity. In those applications, Delaware courts have pegged the anticipated perpetuity-growth rate as necessarily living within the range of values between the anticipated rate of inflation and the anticipated nominal GDP growth.[44] The rate of inflation is considered a floor for a terminal value estimate for a solidly profitable company,[45] while the expected GDP growth rate is considered a ceiling for corporations in mature industries.[46] As is well known by many finance practitioners (though perhaps not appreciated in by utilities regulators), a long-term perpetuity growth rate for a firm in excess of the anticipated GDP growth rate would imply that the firm in question would mechanically come to dominate the entire economy in the long term – a prediction seen by most as simply untenable.[47]

In theory, employing different valuation methodologies for rate setting purposes need not necessarily yield different results. The divergence between the PUCs' preferred model of DCF analysis and the more widely accepted CAPM model may be one of approach, but not outcome. With appropriate inputs, and a reliable market price, the DCF approach should yield a discount rate that is similar to that used by market participants. What is less clear, however, is whether the inputs into the DCF approach are, on the whole, reliable. The expected dividend growth rate—or *E(g)*— used to compute valuations under the DCF model is ultimately and inherently a

[43] Compare: Love and Marriage (Frank Sinatra, lyrics by Sammy Cahn, 1955).
[44] Leo Strine at Global GT LP v. Golden Telecom, p. 26-27, id.
[45] See Lane v. Cancer Treatment Ctrs. Pf Am., Inc., 2004 WL 1752847, at *31 (Del. Ch. July 30, 2004); Peter A. Hunt, STRUCTURING MERGES & ACQUISITIONS: A GUIDE TO CREATING SHAREHOLDER VALUE 51 (2009).
[46] MICHAEL C. EHRHARDT & EUGENE F. BRIGHAM, CORPORATE FINANCE: A FOCUSED APPROACH 242 (2009).
[47] It is worth noting that there are other alternatives to the CAPM, and that the CAPM has its share of weaknesses too; however, it remains a dominant measure of risk-adjustment in finance.

prediction about the future. And, while accurate and reasonable projected estimates of the perpetuity growth rate in dividends could, *in theory*, yield ROE valuation outcomes similar to the CAPM, many of the central vehicles for generating perpetuity growth rates in DCF settings seem pre-programmed to overshoot. The actual degree of divergence of valuations inferred by different decision makers through different valuation methodologies is an empirical question—one we turn to now.

III. Data and Empirical Tests

In this section, we consider data from actual rate hearings in gas and electric utilities over a twelve-year period, evaluating the extent to which the rate setting process mimics a risk-adjusted return mandate. Our approach will be to treat the awarded return on equity from a rate hearing as a type of "asset price", exploring whether such returns in a manner similar to the returns on an equity investment yielding similar returns.

A. Data and Summary Statistics

We use as our primary data source the Public Utilities Fortnightly (PUF) ROE database, which we hand-collected from 2005 through 2016. The PUF data report on awarded ROEs in gas and electric utilities' rate hearings, across all fifty US states, several Canadian provinces, and the District of Columbia. We augmented this data set by merging it with a variety of other sources. First, we added data on several macroeconomic variables and market indicatives that would have been available to the PUC decision makers at the time of each rate hearing, benchmark rates (such as US Treasuries) and widely-utilized historical and forward-looking predictions on the market equity risk premium (taken from Duff & Phelps annual survey). We also collected Compustat and CRSP data for all publicly traded utilities in our sample (or, in many cases, on their publicly traded parents and holding companies[48]), which included firm-specific information on assets, liabilities, accounting returns, and securities market pricing. To this, we added PUC-specific data from the Institute for Public Utilities at Michigan State University, tabulating the composition, elected/appointed nature and political party representation on state PUCs. Finally, we included data on a unique quasi-field experiment in

[48] It is increasingly common for individual utilities to be wholly owned subsidiaries of parent entities, which in turn own other regulated and unregulated firms. This is a limitation in our data – but we also note that it is a limitation in the data that PUCs are often constrained to use as well.

which state PUC commissioners and their staffs received (on a temporally staggered basis) immersion training in finance and valuation.

We begin with summary statistics before proceeding to present results of a series of regression analyses. Consider first the Raw PUF data, which reports on awarded ROEs in announced regulatory hearings. Figure 1 provides a histogram of awarded ROEs for the entire sample.[49] Note from the Figure that there is considerable heterogeneity around the population mean of 10.1%. At the same time, however, awarded ROEs exhibit a pronounced mode at exactly 10%, suggesting it is a focal "odometer" point for regulators. Indeed, this mode at 10% appears strongly to persist over time.

[Insert Figure 1 Here]

The PUF data report on both gas and electric rate hearings, with a small number of combined gas and electric opinions. Table 1 compares the population of gas rate cases to electric cases. Overall, awarded electric ROEs are very slightly larger than those for gas, with a gap of around twenty basis points that tends to widen at the upper ranges of awarded ROEs (sixty basis points at the 95th percentile). While still not statistically significant without controlling for other covariates, this gap will be born out with more comprehensive analysis below, and may reflect additional considerations that high-end electrical generation / transmission projects receive (e.g., solar arrays). Since we treat gas and electric rate cases in the same analysis below, we will typically include controls for the type of case.

[Insert Table 1 Here]

Table 2 reports on awarded ROEs subdivided by jurisdiction (including three Canadian provinces). Note from the table that there does appear to be some inter-jurisdiction heterogeneity. For example, several states in the South seem to have higher awarded ROEs. There many reasons for this heterogeneity, but it suggests the prudence of allowing for jurisdictional-level effects in the regressions we report below.

[Insert Table 2 Here]

[49] It is worth noting that the unit of analysis for Figure 1 (as well as the analysis that follows) is the utility regulator decision. This is not generally the same as the average ROE in effect at any one time. Indeed, because rate hearings are held on intermittent schedules, new rates do not always replace old ones at regularized intervals.

Figure 2a considers awarded ROEs over time, as a function of the order date in the regulatory rate-setting decision. Note from the figure that there is a slight decreasing trend in awarded ROEs over time, starting at nearly 11% in 2005 but decreasing over time to around 9.5% by 2016. Interestingly, however, the overall reduction in awarded ROEs is not accompanied by lower variation in announced rates, which stays roughly consistent over the entire period (standard deviations are generally in the 50-60 BP range), with the exception of 2007 and 2008, where variance increases (standard deviations in the 80-90 BP range). Notwithstanding this aggregate variation over time, it is still clear from Figure 2a that the clustering of ROE awards around 10 percent persists throughout the observational period.

Of course, *raw* awarded ROEs are not particularly well suited to compare to other financial asset prices, without controlling for capital returns. Table 2b thus considers awarded ROE *spreads* over a (roughly) risk-free benchmark: 20-year U.S. Treasury bond yields. Note from the Figure that, unlike Figure 2a there is a clear and strong upward linear trajectory in the spreads between awarded ROEs and treasuries, from around 5.5% in 2005 to approximately 7.5% in 2016. It is also clearly more cyclical than the raw ROEs, suggesting that the rate setting process may be more impervious to cycles in financial markets than the financial assets it is meant to mimic. (This cyclicity is reflected in consistently higher standard deviations of ROE *spreads* above raw ROEs over the entire period, averaging around 20 BPs.) Nearly identical dynamics can be found against other benchmarks.[50]

[Insert Figures 2a and 2b Here]

It is noteworthy from Figure 2b that awarded ROE spreads have not only been cyclical, but that they have widened over time. It is entirely possible, of course, that allowable ROE spreads over treasuries widened over this period because utilities stocks became more systematically risky during that same period. However, Figures 3a and 3b shed considerable doubt on that hypothesis. Figure 3b tracks the raw, monthly CAPM beta estimates of all publicly traded utilities in the PUF data set (based on a 60-month trailing estimate of returns). As is typical of utilities betas, they tend to be below the market-wide measure of 1.0 (though not uniformly). Note that after a slight increasing trend through 2007, equity betas for utilities began

[50] The trends are almost identical against other tenors of U.S. Treasuries, as well as prevailing LIBOR rates.

to beat a steady retreat starting in 2008, and became overall much less volatile through at least the end of 2015. If utilities stocks as a whole were becoming increasingly risky over the period studied, we would expect that utility betas would increase overall as well. But as can be seen from the figure, the utilities-index beta is generally falling over this period. Figure 3a tracks the abnormal returns of utilities ("alpha") over this period, which were very slightly (though not statistically significantly) higher than zero.

[Insert Figures 3a and 3b Here]

Finally, although not strictly an application of asset pricing, it is perhaps worth asking whether the utilities' realized market return on equity subsequent to a rate hearing matches up well with the awarded ROE.[51] This inquiry is in some ways circular, since the rate case is meant to lock in a subsequent ROE. However, utilities may incur costs or investments in assets after the rate case that cause this mechanical identity to fail. Figure 4 provides a histogram of the extent to which awarded ROEs exceeded the mean realized ROE in the two years after the rate case. As can be seen from the figure, awarded ROEs appear to overshoot realized ROEs by between 1.5 and 1.75 percent—a figure that (while not statistically distinct from zero) raises some general questions about how well utilities rate setting operates. This difference in estimates may sound small, but in the electric and gas utilities industry in the United States, with estimated sector market capitalization of $600 billion[52], it translates into roughly $10 billion a year.

[Insert Figure 4 Here]

B. Identification Strategy

(1) Asset Pricing and financial theory

To investigate the conformity of rate decisions with standard predictions from finance, we now proceed to consider the awarded ROE, treating it as if it were an asset-pricing return on a traded financial asset. More specifically, to assess whether regulators are setting ROEs in a

[51] We calculate realized market return on equity as the investment return (including distributions) realized shareholders over the two years subsequent to the rate hearing.
[52] http://www.investopedia.com/articles/investing/031116/utilities-sector-industries-snapshot-nee-gas.asp

manner consistent with risk-adjusted returns, we test whether awarded ROEs behave on average in a manner that would predicted by the Capital Asset Pricing Model at the time the regulatory decision is made. We focus on CAPM for a variety of reasons. First, it is well known and accepted among finance practitioners and academics as a vehicle estimating returns. By contrast, the (so-called) DCF approach described above has far less acceptance. Second, unlike other empirical asset pricing models (such as Fama-French or other multi-factor models), the CAPM's key input – the market equity risk premium (ERP) – has readily available *forward looking* predictions available for it. Such predictions, in fact, are a key input into valuation arguments that utilize the CAPM, and are generally not available for Fama-French.

The methodology we use requires essentially a two-step process. First, we use CAPM to derive forward-looking predictions of ROE spreads for each utility in our data set at the time of the rate announcement. Second, we compare these predictions to the ROE spreads actually awarded by the regulator, which (as noted above) we hand-collect from 2005 through 2016. The second stage of this process is represented as follows. For each observed rate case with an ROE finding, we consider the following specification:

$$\left(R_{i,t} - r_{f,t}\right) = c_0 + c_1 \cdot \hat{S}_{i,t} + \gamma \cdot Z_{i,t} + \varepsilon_{i,t} \tag{4}$$

where $\left(R_{i,t} - r_{f,t}\right)$ represents the awarded ROE spread over the risk free rate for utility *i* at time *t*, $Z_{i,t}$ is a series of controls (discussed below, and including potential experimental manipulations) and $\varepsilon_{i,t}$ is an error term. The term $\hat{S}_{i,t}$ in (2) is the *predicted* spread of utility *i*'s stock at time *t*, which we derive at the utility level from the predictions of the CAPM. This predicted spread is given by the well-known expression:

$$\hat{S}_{i,t} = \alpha_{i,t} + \beta_{i,t} \cdot E\left(R_{M,t} - r_{f,t}\right) \tag{5}$$

where $\beta_{i,t}$ is the utility stock's risk relative to the market (its "beta"), $\alpha_{i,t}$ is the stock's abnormal deviation from the CAPM (or its "alpha"), and $E\left(R_{M,t} - r_{f,t}\right)$ is the anticipated equity risk premium (ERP). Although the textbook version of CAPM predicts that $\alpha_{i,t} = 0$ for all securities, we allow for deviations based on empirical relationships observable at the time of the rate hearing (and plausibly applicable to utilities). If regulator behavior is consistent with the predictions of CAPM, we would expect $c_0 = \gamma = 0$, and $c_1 = 1$ in Equation (4).

In all the regressions below, we utilize estimated utility- and time-specific values of $\alpha_{i,t}$ and $\beta_{i,t}$, using firm-level data if the utility is public and industry proxies otherwise. In our baseline specifications, we omit all non-CAPM controls; but later we include other (theoretically extraneous) controls that pertain to the commission hearing the rate hearing, including political party composition, size, and fraction elected versus appointed, as well as size and capital structure data on the utility. (This allows us to test the null hypothesis that all extraneous variables are irrelevant to the ROE determination—a hypothesis we reject.) As noted above, the strong prediction of the CAPM is that the coefficient $c_1 = 1$ while $c_0 = 0$. We acknowledge, as others have noted, the CAPM may under-predict returns for smaller-capitalization firms, as well as firms that have extreme market-to-book ratios, inducing a non-zero estimate of $\alpha_{i,t}$. However, we attempt to control for this by including estimates of $\alpha_{i,t}$ when available.

Our analysis explores a variety of estimation approaches for (4) and (5). For publicly traded utilities, we utilized both raw estimated 60-month alphas and betas (as of the month of the rate order), as well as a blended "Ibbotson-adjusted" values of alpha and beta which is a weighted average of the raw beta and/or alpha (weight 2/3) with industry wide counterparts (weight 1/3). For non-traded utilities, the industry alpha and beta prevailing at the time of the PUC order are used. For the ERP, we consider both the historical ERP measure and the (supposedly) more forward looking "Supply-Side" measure, both widely employed by financial professionals and provided by Duff and Phelps on an annual basis.[53] (We confirmed that each of these measures would have been available to the PUC at the time of each rate order.)

Consider our first set of regressions pictured in Table 3, which reports on a basic set of CAPM regressions (with standard errors clustered at the state level, as in all remaining regressions). Note from the Table that our key coefficient of interest, c_1, is not only nowhere near 1.0 (as predicted by the CAPM), but it is consistently *negative* in value. In all specifications, the estimate of c_1 is statistically and economically distinct from its predicted value (of 1) at any conventional confidence level. In addition, the constant (c_0) in the regression appears to reflect a substantial "regulatory abnormal return" embedded in the awarded ROE, above and beyond abnormal deviations predicted through empirical alpha values. The

[53] In all cases, we utilize the ERP predictions from Duff & Phelps, Stocks, Bonds, Bills, and Inflation (SBBI) Yearbook (2005-16) (now published by Wiley & Sons).

inconsistency of awarded ROEs with CAPM, moreover, persists even in the presence of state and year fixed effects.[54] We view this as strong evidence that whatever regulators are doing, they are *not* generally applying accepted asset pricing models to generate forward-looking estimates of equity cost of capital.

[Insert Table 3 Here]

(2) Extended Model

We now proceed to test several correction factors, shedding light on possible factors driving the deviation of regulators from CAPM predictions. If PUCs are not adhering, on average, to asset-price mimicking behavior, then what may be driving their decisions? In this section we lay out a set of hypothesis for $Z_{i,t}$ that might explain the phenomenon, and test them empirically.

a. Financial stability

The patterns we observe above may be driven by risk- or ambiguity-aversion among regulators, who disproportionally discount upside relative to downside political uncertainties.[55] The incentives underlying commissioners' decision making potentially result in a more risk averse policy than is socially desirable. Because the operating failure of utilities is often considered as a social catastrophe, regulators are likely internalize the risk of a financial failure of utilities as cataclysmic.[56] Commissioners are the ultimate political risk bearers for the utility's financial stability; financial distress of the utility carries a heavy political toll. In contrast, the costs of excessive electricity rates is a diffuse one, dispersed among all electricity consumers. Slavishly sticking to standard asset pricing formulations could incentivize utilities to run operations extremely close to the bone. Interruptions in the continuous electricity service and

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[54] We note that the inclusion of year fixed effects could absorb much of the explanatory power of our predicted spreads based on CAPM (since the ERP figures vary only annually). Nevertheless, the abnormal regulatory returns remain significant in these specifications.
[55] Eric L. Talley, *On Uncertainty, Ambiguity, and Contractual Conditions*, 34 DEL. J. Corp. L. 755, 767 (2009).
[56] Talley, supra note 55 *id*.

financial distress of the utility undermine the public trust in the commission, potentially leading to a crisis of confidence in public governance.[57]

Commissioners' interests are thus better served by a bias toward greater institutional stability. Significantly, the asymmetrical regulatory incentives and the presence of regulatory capture or revolving doors are independent variables. Commissioners' interests are better served by promoting the industry's interests in higher rates regardless of their future employment opportunities at the regulated industry. Even the most dedicated public servant is expected to be biased towards higher rates given the expected public opinion in case of an operating default. As higher leverage typically results in higher estimated probabilities of financial distress[58], theoretically, utilities can use this regulatory risk aversion and strategically add higher leverage and thereby induce regulators to award higher rates. It is therefore a plausible hypothesis that rate regulators will respond to leverage as a prominent proxy in their rate-making process.

Realized ROEs tend to be persistently and positively related to leverage of all firms, including utilities as shown in Figure 5 below (generated from all public utilities represented in the PUF data).

[Insert Figure 5 Here]

However, our results suggest that in the regulated setting, higher debt-equity ratios appear to have no systematic relationship to awarded ROEs, and leverage appears not to have predictive value as to awarded ROEs (as shown in Table 4 below).

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[57] Azgad-Tromer, supra note __ id. Interruptions of power provision are often considered as social catastrophe and induce a crisis of confidence in public governance, triggering political response. For example, as California utilities were facing bankruptcy in 2001, California imposed statewide rolling blackouts, and ultimately authorized hundreds of millions of dollars to ensure adequate power flows, in what is often referred to as the "California Energy Crisis". LINCOLN L. DAVIES, ALEXANDRA B. KLASS, HARI M. OSOFSKY, JOSEPH P. TOMAIN AND ELIZABETH J. WILSON, ENERGY LAW AND POLICY 54 (2015). In 2003, blackout in the East Coast led to loss of power to over 50 million consumers as the networks in New York, Ontario, Northern Ohio, Michigan and a portion of other states collapsed, with over 60,000 MW of generating capacity knocked out of service, initiating the codification of reliability standardization by the U.S. Congress. https://en.wikipedia.org/wiki/Northeast_blackout_of_2003; http://www.elp.com/Electric-Light-Power-Newsletter/articles/2016/08/13-years-after-the-northeast-black-of-2003-changed-grid-industry-still-causes-fear-for-future.html

[58] For this reason, financial regulators often supervise leverage ratios in banks. See for example Basel III leverage ratio requirements : http://www.bis.org/publ/bcbs189.pdf

b. Operating Reliability

Rate regulators possibly aim to use the rate setting process to sustain thicker operating margins and thereby enhance the reliability of power provision and generation. The continuous and uninterrupted power service is an inherent expectation of our social lives, a core element of the social contract. Higher rates may serve to create an equity cushion that mitigates the risk of power outages due to the technical determinants of electrical energy provision. Reliable and continuous service by utilities requires such equity cushion due to the technical demands of energy provision. First, expenditures are particularly volatile for utilities, as their critical infrastructure is typically very expansive and custom-made, and is prone to severe storms and other natural disasters.[59] Excess capacity induced by supranormal rates may thus serve to sustain operating reserves sufficient to respond to sudden outages of generating plants or transmission lines, sufficiently quickly to accommodate the frequency, voltage, and stability technical parameters required to respond and sustain reliability of electricity service.[60] Second, because electric energy cannot be easily stored, it must be produced and delivered practically simultaneously. "Inventorying" power is still beyond the capacity of most generators. Sustaining the continuous and uninterrupted electricity service therefore requires maintenance of continuous and almost instantaneous balance between production and consumption of electricity in power systems.[61] On certain occasions (such as the Super Bowl), utilities can expect the spike in demand, but not all spikes and dips can be foreseen. To mitigate the risk of power shortages and blackouts, some margin of excess generation capacity above the expected demand load must be kept at all times.[62] Higher awarded rates can sustain investments in excess capacity and thereby enhance the reliability of energy provision in light of the volatility of capital expenditures and the lack of technical storage feasibility.

We are currently investigating these relationships empirically.

c. Commission Composition

Table 4 expands the analysis of Table 3 by adding a variety of firm-level and / or PUC-level controls, as well as a control for electricity rate cases.[63]

[Insert Table 4 Here]

Commission-level controls in Table 4 appear to provide some parts of the story behind regulatory rate setting. Note first that the number of commissioners on the PUC tends to predict a small reduction in "abnormal" awarded ROEs, possibly reflecting the possibility that larger commissions will are more likely to have either commissioners or staff with financial expertise. In addition, we find that the percent of the commission that is elected predicts lower awarded ROEs, with completely elected commission tending to award over 100 basis points lower returns on equity than completely appointed ones. This electoral effect may represent the cost that commissioners pay with rate payers by setting rates too high, and/or the greater impediments to regulatory capture by elected commissioners. Party-affiliated commissioners also appear to be associated with lower ROEs, though this effect does not appear to persist with the introduction of state and year fixed effects, which are likely to absorb party-associated effects for relative stable PUC political compositions (as many are).

This result prompts the need in further research on structural design of the rate setting process. Most of the literature that is concerned with regulatory capture has been developed in the context of utility regulation.[64] Regulators often have an industry background, and their discretion may be biased due to the cultural proximity, including the shaping of assumptions, lenses and vocabularies as well.[65] Industry actors may provide a variety of inducements, including future employment options and selectively burnishing the reputational capital of commissioners, each of which might enhance their tendency to make pro-industry decisions.[66]

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[63] All regressions in the Table utilize Ibbotson-adjusted Beta estimates and Supply-Side ERPs.

[64] Ernesto Dal Bo, *Regulatory Capture: An Overview*, 22 OXFORD REVIEW OF ECONOMIC POLICY 203 (2006). Capture was recently defined by The Tobin Project as "the result or process by which regulation… is consistently or repeatedly directed away from the public interest and towards the interests of the regulated industry"

[65] James Kwak, Cultural Capture, in PREVENTING REGULATORY CAPTURE supra note **Error! Bookmark not defined.** id. DANIEL CARPENTER AND DAVID A. MOSS, PREVENTING REGULATORY CAPTURE 15 (2014).

[66] For a specific application of revolving doors in public utility commissions, see Marc T. Law and Cheryl X. Long, *Revolving Door Laws and State Public Utility Commissioners*, 5 REGULATION & GOVERNANCE 405–424 (2011). For a strategic defense of revolving doors' efficiency see David J. Salant, David J, Behind the Revolving Door: A New View of Public Utility Regulation, 26(3) THE RAND JOURNAL OF ECONOMICS, 362–377 (1995).

The institutional, professional and social proximity of rate regulators to executives of regulated utilities suggests that aspects of regulatory capture may play some role, though we are not readily able to quantify this effect. Indeed, few regulators have been found guilty of corruption and capture theory has scant empirical support. The literature on capture remains focused on inferences from statistical correlations: Looking at the ultimate beneficiaries of the regulatory outcome and inferring the regulatory purpose from there.[67] Our results suggest that some regulatory structures may be more susceptible to capture than others, possibly suggesting various potential defense mechanisms jurisdictions might utilize. (We leave such questions largely to future research.)

d. Expertise and Training: A Quasi-Field Experiment

Although PUC commissioners and staff may be incentivized by a variety of factors other than asset-pricing concerns when setting rates, another factor deserving attention is whether the regulatory decision makers simply lack the expertise to evaluate finance-based arguments, thereby causing them to look to orthogonal factors. In other words, is the stark deviation from the predictions of CAPM illustrated above an artifact of some type of regulatory limitation on competence or receptivity to finance, or is it more reflective of inadequate training of regulators?

Our data allow us to test this question, using a fortuitous natural experiment. The Institute for Regulatory Law & Economics (IRLE) is a regulatory training endeavor sponsored by the University of Colorado Law School's Silicon Flatirons Center as a means of supporting thoughtful regulatory decision-making. From 2004-2016, the IRLE hosted an annual one-week summer workshop for state public utility commissioners and staff, with the goal of educating regulators about how to use economic analysis within the regulatory decision making.[68] The IRLE advertised its annual program as follows:

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[67] Daniel Carpenter, D*etecting and Measuring Capture,* in PREVENTING REGULATORY CAPTURE: SPECIAL INTEREST AND HOW TO LIMIT IT (Daniel Carpenter and David A. Moss eds,2014); Ernesto Dal Bo and Martin A. Rossi, C*orruption and Inefficiency: Theory and Evidence from Electric Utilities*, 91 JOURNAL OF PUBLIC ECONOMICS, 939-962 (2007).For a specific application of revolving doors in public utility commissions, see Marc T. Law and Cheryl X. Long, *Revolving Door Laws and State Public Utility Commissioners*, 5 REGULATION & GOVERNANCE 405–424 (2011). For a strategic defense of revolving doors' efficiency see David J. Salant, David J, Behind the Revolving Door: A New View of Public Utility Regulation, 26(3) THE RAND JOURNAL OF ECONOMICS, 362–377 (1995).

[68] The institute did not host a Summer Workshop in 2015.

> Each May, the IRLE hosts a seminar geared towards educating state regulators about economic analysis of regulatory policy issues. Notably, the Institute distills the critical law and economics issues that arise in closely-regulated network industries and presents them in a coherent fashion. To present its curriculum, the IRLE draws on the expertise of leading academics, practitioners, and scholars. In short, the IRLE teaches regulators how to appreciate insights that emerge from important economic principles and concepts as well as how to apply them to regulatory situations in network industries.[69]

For the first four years of the workshop, finance was *not* included as part of the curriculum; but beginning in 2008, the IRLE began to devote an entire day (6 hours of lecture time) to finance, where regulators were exposed to some of the key components to discounted cash flow analysis and the CAPM, using examples from actual rate cases to motivate discussion.[70]

Although participants in the workshop were required to opt into attendance (and thus they self-selected), the mid-stream introduction of finance content helps to address some of the concerns that one might have with selection bias. In several baseline specifications, we compare treated commissions (i.e., those who attended) with untreated ones (those who never attended). However, in other specifications we consider the effect of finance training solely within the population of commissions that opted the IRLE workshops (effectively constructing a "placebo" group consisting of those PUCs who opted into the workshop but did not receive finance training in the first four years). Table 5 summarizes the first year in which the commissions in our observation sample attended IRLE's program, as well as the first year the commission received "treatment" by finance training. (In some cases, the commission attended the program but did not receive finance treatment because their years of attendance pre-dated the provision of finance).

[Insert Table 5 Here]

Our identification strategy comes from the following specification:

$$\left(R_{i,t} - r_{f,t}\right) = c_0 + c_1 \cdot \hat{S}_{i,t} + c_3 \cdot FinTrain_{i,t} + c_4 \cdot FinTrain_{i,t} \cdot \hat{S}_{i,t} + \gamma \cdot Z_{i,t} + \varepsilon_{i,t} \tag{6}$$

[69] IRLE Website: https://siliconflatirons.org/events/institute-for-regulatory-law-and-economics-irle/

[70] In the interests of full disclosure, one of the co-authors of this study (Talley) delivered the finance course in every year it was offered.

This specification is identical to equation (4), except for the addition of (a) an affine treatment effect variable $FinTrain_{i,t}$ that takes on the value of 1 if any member/staffer of PUC i has received finance training treatment on or before year *t*, and (b) a slope-shifting interaction term $FinTrain_{i,t} \cdot \hat{S}_{i,t}$, which allows for a training-induced change in the coefficient on the slope of the expected spread of the utility. The treatment effect from CAPM training would thus plausibly be reflected through shocks to both coefficients c_3 and c_4. Given the deviations from CAPM found in Tables 3 and 4 above, training would induce regulatory decisions more line with finance theory if $c_3 < 0$ and/or $c_4 > 0$. (Note in addition that the average combined CAPM coefficients for treated commissions would be a summed shift effect of $(c_0 + c_3)$ and a summed slope effect of $(c_1 + c_4)$.)

Tables 6 summarizes our results.[71] In the Table, the left panel considers all untreated PUCs, as a control, regardless of whether they opted to attend the IRLE program; the right panel retains only those PUCs that participated in the IRLE program (a universe that includes a "placebo" group never treated with finance training). As the Table illustrates, finance training results in some *moderate* effects on later ROE setting. First, the effect of finance training on the shift parameter (c_3) is consistently negative and statistically significant in the presence of various utility-level controls. Its economic significance (around 50 bps) is also notable, representing just under one standard deviation in raw announced spreads (see Table 1). Second, finance training also alters the CAPM slope coefficient the predicted direction, albeit modestly. The point estimates of the slope parameter (c_4) is mildly positive, but not statistically significant; and the point estimate is high enough that, when combined with the baseline slope estimate, treated PUCs exhibit a very slight positive relationship between systematic risk and awarded ROE. The electoral responsiveness of commissions appears to persist in the presence of treatment, but the size effect disappears in the right panel of regressions, suggesting that PUCs seeking treatment (regardless of whether they received finance training) tended to alter their decision making less as a function of size than untreated commissions.

[Insert Table 6 Here]

[71] As with the previous results, Table 6 clusters standard errors at the state level.

Two caveats deserve explicit attention before proceeding. First, we cannot rule out whether our findings as to the trainability of PUC regulators and staffs turned critically on the specific design of the treatment offered. The training program, part of a larger week-long immersion program in regulatory law and economics, was consistently staffed by substantially the same faculty over the observation period, proceeding in roughly consistent sequence. Although we observe program where finance training was not part of the curriculum (a convenient form of heterogeneity for selection-bias correction), our data therefore still do not permit us to distinguish about whether a peculiar aspect of this specific program was particularly effective.[72]

Second, to the extent that training is effective, we want to be cautious about whether greater fidelity to asset pricing is itself conducive to overall welfare concerns. Indeed, to the extent that accurate risk-adjusted returns adjudication crowds out other laudable social policy goals, the trainability of regulators may ultimately be normatively undesirable, at least for certain plausible alternative objectives regulators may pursue (such as dynamic incentive provision). We note, however, that while training tends to dampen several other predictive factors in rate-setting, they remain in the picture, and thus it does not necessarily follow that better risk pricing necessarily crowds out other goals.

All told, we view these results as evidence that there exists some potential to train legal decision-makers to utilize the concepts of finance. We note that the effect is concentrated in the shift parameter, and that it is still a fraction of the size of the abnormal portion of the ROE spread. Training evidently has mild effects on PUCs' responsiveness to prevailing systematic risk through the slope parameter. It may be possible that a multi-day or otherwise more immersive form of training would have even greater effects, but our data do not permit us to unpack this possibility.

[72] We note, for example, that finance training component in all observed years was provided by a single instructor (Talley).

IV. Conclusion

Under U.S. law, a public utility is entitled to earn a return on the value it employs for the convenience of the public equal to that made on investments in other businesses which are attended by corresponding risks.[73] We conducted an empirical analysis of rates awarded by PUCs in the U.S. and in Canada over a twelve year period (2005-2016), in order to assess the relationship of awarded rates of return on equity to standard asset pricing models adjusting expected rates of return with anticipated risks. Our analysis demonstrates that rate setting practices adopted by PUCs diverge appreciably (even violently) from the predictions of financial economics across numerous dimensions.

Instead, our analysis suggests that current regulatory practice more plausibly reflects an amalgam of other desiderata that include political goals, incentive provision, insufficient financial expertise and regulatory capture. We identify some factors may be at play, including the possibility that regulators' behavior reflects objectives that are either orthogonal or opposed to precise risk-return calibration, such as serving political constituencies, providing dynamic incentives, and possibly even regulatory capture. We find evidence that the structural composition of the commission is correlated with the awarded rates: The percent of the commission that is elected predicts lower awarded ROEs, with completely elected commission tending to award up to 115 basis points lower returns on equity than completely appointed ones. We additionally conjecture that the divergence of observed regulatory behavior from asset-pricing fundamentals may be due (in part) to a lack of financial valuation expertise among regulators. To test this conjecture, we study a unique field experiment that exposed commissioners and their staffs to immersion training in finance. We find evidence that treated PUCs began to issue ROE rulings that were (moderately) more aligned with standard asset pricing theory than those of untreated placebo groups.

[73] Bluefield Waterworks v. Public Service Comm'n, 262 U.S. 679 (1923). Accord FPC v. Hope Natural Gas Company, 320 U.S. 591 (1944)

Appendix: Tables and Figures

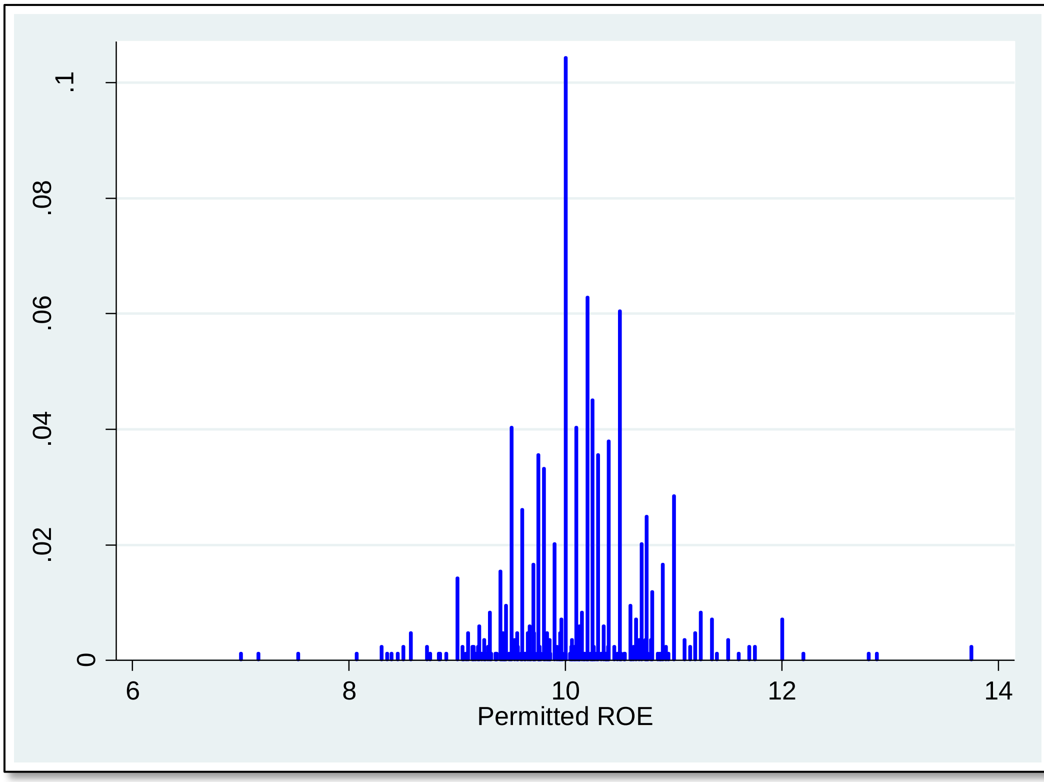

Figure 1: Histogram of Awarded ROEs (Source: Public Utilities Fortnightly, 2005-2016)

	Combined	Gas	Electric
Mean	10.113	10.014	10.188
S.D.	0.650	0.635	0.647
5%	9.14	9.05	9.23
25%	9.75	9.69	9.80
50%	10.10	10.10	10.15
75%	10.50	10.40	10.50
95%	11.00	10.85	11.25
N Obs	844	364	482

Table 1: Awarded ROE by Utility Type

State	Obs	Mean	S.D.	Min	Max	State	Obs	Mean	S.D.	Min	Max
AB	4	9.288	1.324	8.3	11.1	NC	10	10.460	0.306	10	11
AK	8	10.817	1.441	9.3	12.875	ND	9	10.350	0.483	9.5	10.75
AL	4	12.275	1.703	10.8	13.75	NE	4	9.925	0.395	9.6	10.4
AR	14	9.829	0.285	9.4	10.25	NH	5	9.636	0.076	9.5	9.67
AZ	12	9.938	0.490	9.5	11	NJ	10	9.920	0.283	9.55	10.3
CA	24	10.797	0.689	8.5	11.6	NL	1	8.500	.	8.5	8.5
CO	21	10.131	0.988	7.53	12	NM	7	9.906	0.293	9.48	10.27
CT	13	9.486	0.498	8.75	10.25	NV	15	10.163	0.420	9.3	10.7
DC	5	9.555	0.284	9.25	10	NY	44	9.514	0.464	9	10.7
DE	6	9.908	0.213	9.7	10.25	OH	13	10.258	0.301	9.84	10.65
FL	15	10.740	0.539	10	11.75	OK	13	10.280	0.343	9.5	10.75
GA	6	10.728	0.346	10.12	11.15	ONT	12	8.958	0.480	8.35	9.43
HI	9	10.200	0.570	9	10.7	OR	22	9.882	0.247	9.4	10.175
IA	11	10.609	0.835	10	12.2	PA	3	10.267	0.231	10	10.4
ID	15	10.170	0.595	9.5	12	QUE	1	8.900	.	8.9	8.9
IL	53	9.807	0.560	8.72	10.68	RI	5	9.960	0.508	9.5	10.5
IN	33	10.002	0.613	7	10.5	SC	11	11.009	0.717	10.2	12
KS	9	9.756	0.422	9.1	10.4	SD	1	9.250	.	9.25	9.25
KY	16	10.252	0.228	9.8	10.63	TN	5	10.206	0.166	10.05	10.48
LA	23	10.648	0.477	9.95	11.25	TX	24	9.869	0.254	9.5	10.4
MA	18	9.737	0.319	9.2	10.35	UT	11	10.160	0.294	9.8	10.61
MD	23	9.767	0.327	9.31	11	VA	28	10.118	0.438	9.5	11.5
ME	7	9.929	0.766	8.45	11	VT	7	9.923	0.427	9.45	10.7
MI	39	10.472	0.323	9.9	11.15	WA	29	10.045	0.285	9.5	10.4
MN	31	10.054	0.682	7.16	10.88	WI	86	10.457	0.414	9.45	11.2
MO	23	10.132	0.479	9.5	11.25	WV	1	9.750	.	9.75	9.75
MS	5	9.587	0.315	9.225	10.07	WY	18	10.144	0.507	9.5	10.9
MT	2	9.650	0.212	9.5	9.8						

Table 2: Awarded ROE by Jurisdiction (Incudes some Canadian Provinces)

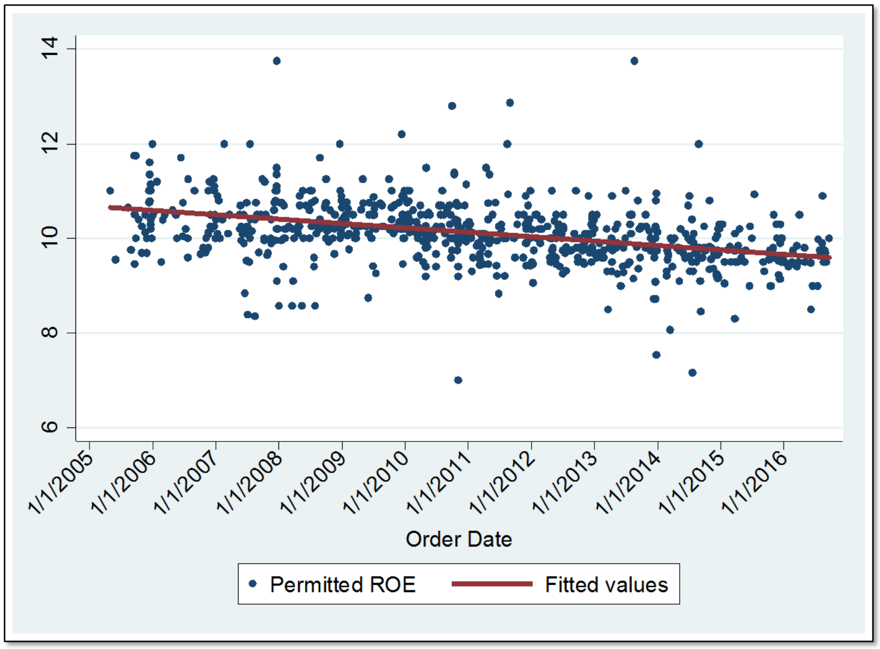

Figure 2a: Awarded ROEs, by Order Date

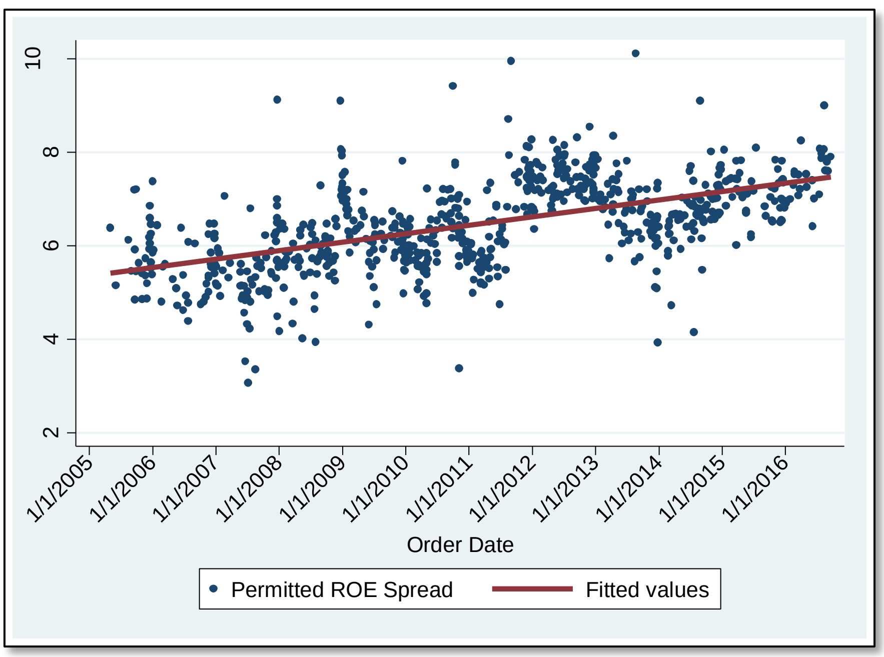

Figure 2b: Awarded ROE spreads over 20-yr US Treasuries, by Order Date

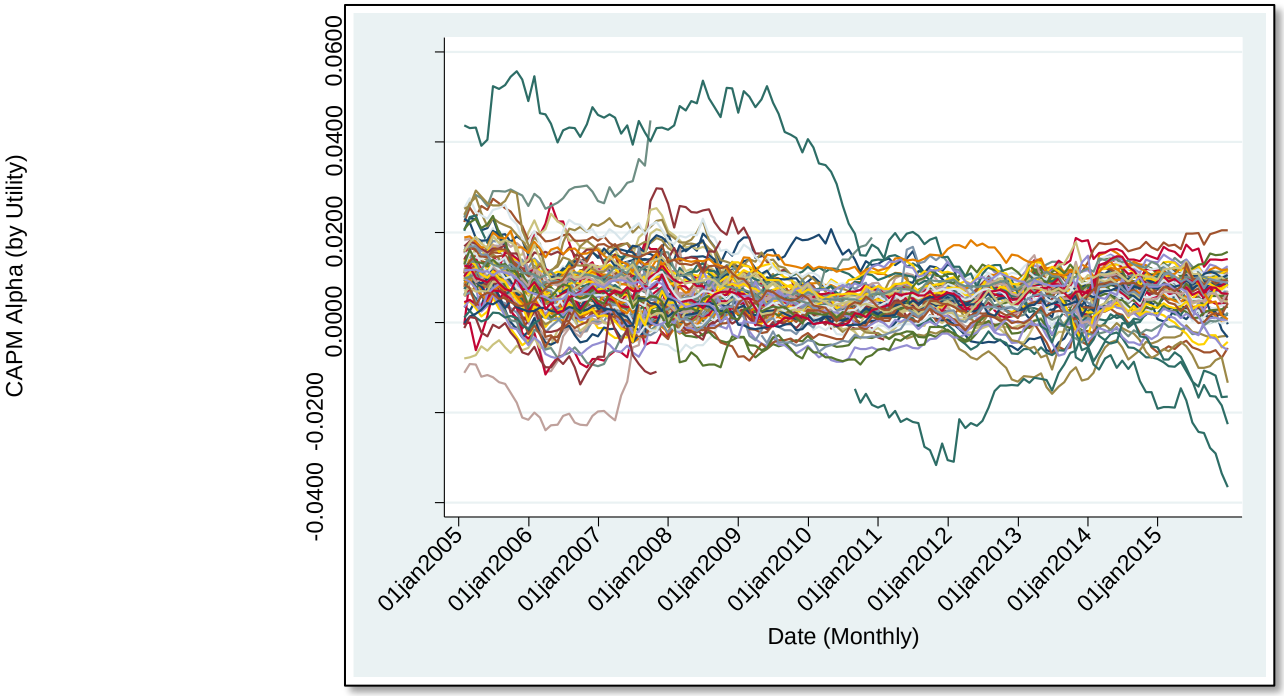

Figure 3a: Utility Alphas, by Month (60-month trailing CAPM estimation). Source: CRSP

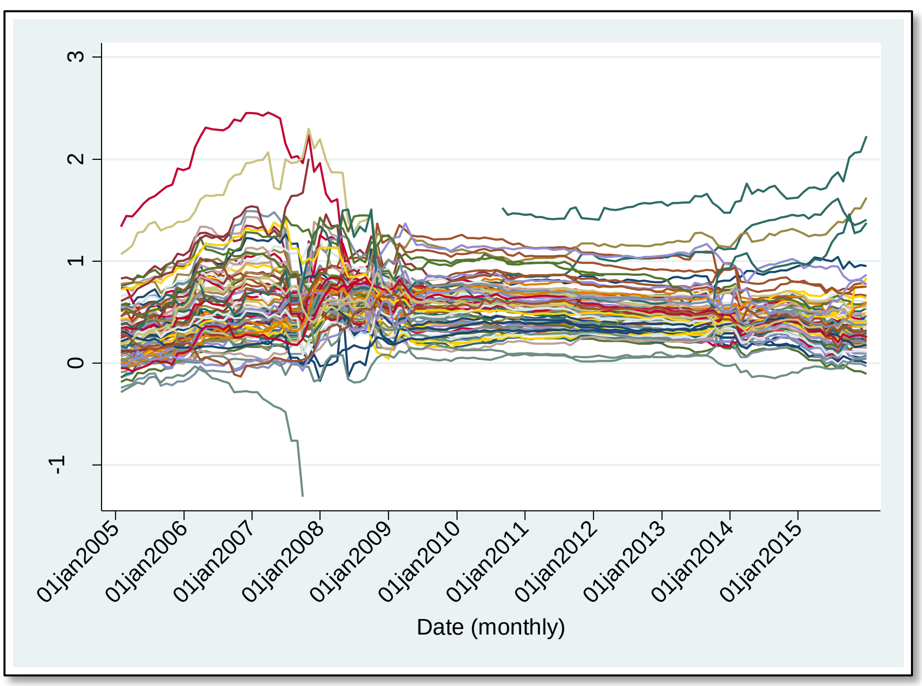

Figure 3b: Utility Betas, by Month (60-month trailing CAPM estimation). Source: CRSP

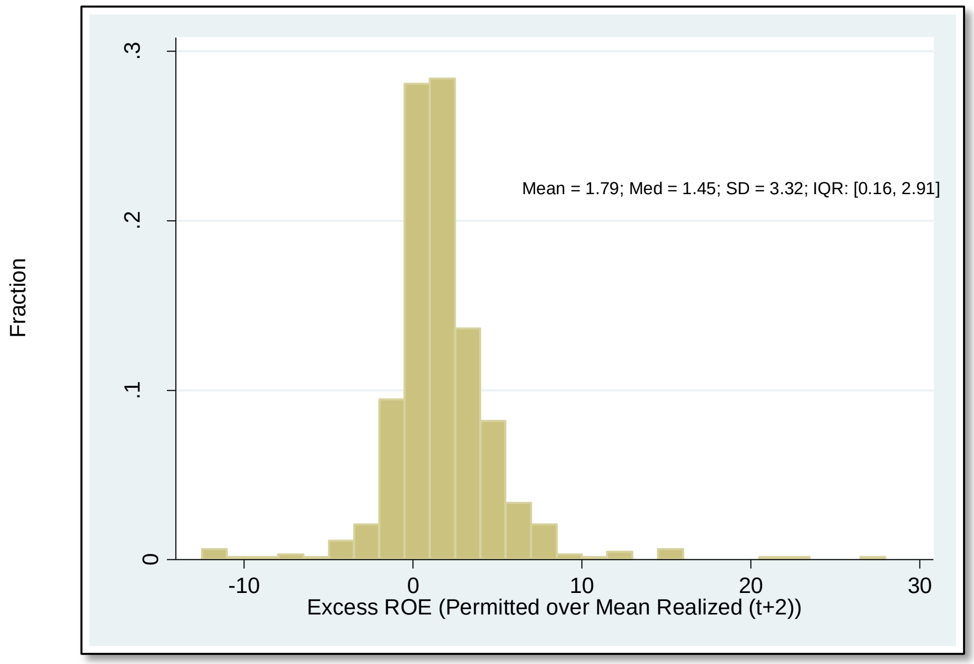

Figure 4: Excess of Awarded ROE over Mean Realized ROE (Two-Year Lead)

	Raw a & bx Historical ERP				Raw a & bx Supply-Side ERP			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
a + b· ERP	-0.136***	-0.011	-0.141***	-0.013	-0.142***	-0.011	-0.147***	-0.014
	(-7.62)	(-0.80)	(-7.46)	(-0.93)	(-7.00)	(-0.73)	(-6.85)	(-0.88)
Constant	7.038***	7.658***	7.061***	7.735***	7.002***	7.655***	7.022***	7.733***
	(69.52)	(69.01)	(88.51)	(91.13)	(69.49)	(69.26)	(86.54)	(90.90)
State Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
Year Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.0608	0.5052	0.061	0.506	0.0527	0.5052	0.053	0.506
c^2	58.093	1173.033	55.61	106.64	48.967	1166.418	46.92	106.62
p-val	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N	840	840	840	840	840	840	840	840
H_A: a + b · ERP = 1	4068***	5684***	3649***	5211***	3163***	4338***	2853***	4022***
H_B: a + b · ERP = 1\ Constant = 1	5219***	7493***	7834***	4723***	4907***	6574***	7489***	4412***

	Ibbotson a & bx Historical ERP				Ibbotson a & bx Supply-Side ERP			
	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]
a + b· ERP	-0.229***	-0.014	-0.236***	-0.018	-0.237***	-0.015	-0.243***	-0.019
	(-8.86)	(-0.71)	(-8.66)	(-0.85)	(-8.00)	(-0.64)	(-7.81)	(-0.79)
Constant	7.437***	7.671***	7.469***	7.753***	7.363***	7.667***	7.389***	7.748***
	(61.52)	(63.04)	(64.53)	(79.30)	(60.88)	(63.21)	(62.50)	(78.90)
State Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
Year Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.0865	0.5051	0.086	0.506	0.0731	0.5051	0.073	0.506
c^2	78.469	1168.482	75.08	106.56	64.017	1161.716	60.92	106.54
p-val	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N	840	840	840	840	840	840	840	840
H_A: a + b · ERP = 1	2254***	2542***	2053***	2363***	1748***	1936***	1593***	1819***
H_B: a + b · ERP = 1 & Constant = 1	3811***	4333***	4164***	3149***	3924***	4124***	3906***	3172***

Table 3. CAPM OLS regressions. Dependent Variable = Permitted ROE spread over 20-year US Treasuries, by rate case. The panels explore permutations of equity as and bs (Raw versus Ibbotson-adjusted) and the market Equity Risk Premium (Historical versus Supply-Side), always estimated on the month of the PUC order. (For non-traded utilities, the industry a and b prevailing at the time of the PUC order is used.) Test statistics for notable CAPM hypotheses are shown in the bottom of each panel. Notation {+, *, **, ***} denotes significance at the {0.10, 0.05, 0.02, 0.01} levels; t-stats in parentheses. Standard Errors clustered by state.

	[1]	[2]	[3]	[4]	[5]	[6]
a + b· ERP	-0.217***	-0.222***	-0.209***	-0.022	-0.023	-0.024
	(-7.66)	(-7.17)	(-6.98)	(-0.90)	(-0.96)	(-0.91)
Constant	6.775***	8.275***	7.811***	7.558***	8.057***	8.091***
	(23.11)	(27.74)	(16.79)	(26.88)	(40.19)	(23.49)
Electric	0.092	0.182***	0.095	0.175***	0.188***	0.163***
	(1.46)	(2.99)	(1.60)	(4.02)	(4.54)	(3.90)
ROE	-0.002		-0.004	0		0
	(-0.43)		(-1.06)	(0.02)		(-0.20)
ln(Assets)	0.063+		0.069+	0.005		0.007
	(1.85)		(1.83)	(0.19)		(0.25)
D/E Ratio	-0.034		-0.025	0.009		0.016
	(-0.92)		(-0.62)	(0.34)		(0.54)
# of Commissioners		-0.138***	-0.143***		-0.061*	-0.083**
		(-3.58)	(-3.74)		(-2.21)	(-2.58)
Percentage Elected		0.24	0.169		-1.171***	-1.168***
		(1.00)	(0.67)		(-3.76)	(-3.52)
Percentage Women		0.163	-0.026		0.074	-0.051
		(0.48)	(-0.08)		(0.36)	(-0.23)
Percentage Democrat		-0.898***	-0.790***		-0.015	0.08
		(-3.55)	(-3.47)		(-0.09)	(0.49)
Percentage Republican		-0.523*	-0.497+		0.012	-0.001
		(-1.98)	(-1.86)		(0.07)	(-0.01)
State Fixed Effects	No	No	No	Yes	Yes	Yes
Year Fixed Effects	No	No	No	Yes	Yes	Yes
R^2	0.10	0.15	0.16	0.55	0.53	0.56
c^2	75.466	175.353	180.195	112.73	17288.17	322.97
p-val	0	0	0	0	0	0
N	705	823	699	705	823	699
H_A: a + b · ERP = 1	1853***	1555***	1634***	1692***	1847***	1516***
H_B: a + b · ERP = 1 & Constant = 1	1884***	2059***	1783***	910***	1141***	773***

Table 4. CAPM regressions with additional utility- and PUC-level controls. Dependent Variable = Permitted ROE spread. All Beta computations are Ibbotson adjusted and use Supply-Side Equity Risk Premium. Test statistics for notable CAPM hypotheses are shown in the bottom panel. Notation {+, *, **, ***} denotes significance at the {0.10, 0.05, 0.02, 0.01} levels; t-stats in parentheses. Standard Errors clustered by state.

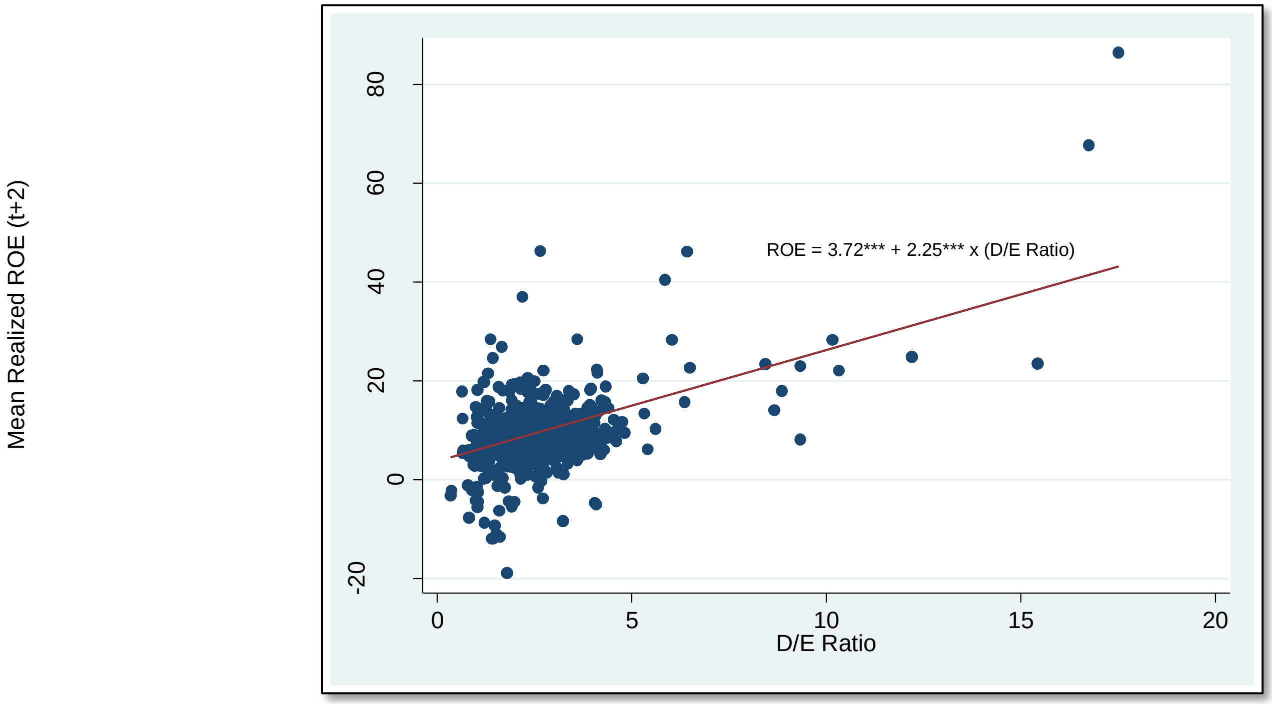

Figure 5. Mean Realized ROE (Two-Year Lead) and D/E Ratio. Source: Compustat, 2005-2016. (***=significance at the 0.001 level)

State	1st IRLE Year	1st Finance Year	State	1st IRLE Year	1st Finance Year
AL			MT	2004	2011
AK	2004	2008	NE		
AZ	2010	2010	NV		
AR	2004	2016	NH	2005	
CA	2004		NJ		
CO	2004	2008	NM	2005	
CT	2011	2011	NY		
DC	2004	2009	NC	2004	2016
DE			ND	2004	2010
FL	2004	2012	OH	2012	2012
GA			OK	2005	
HI			OR	2004	2013
ID			PA	2013	2013
IL	2005	2008	RI	2005	2008
IN	2004	2008	SC	2005	2009
IA	2004	2011	SD	2004	2013
KS	2004	2011	TN	2006	2011
KY	2012	2012	TX	2005	
LA			UT		
ME			VT	2007	2008
MD	2004		VA		
MA	2004	2008	WA	2007	2012
MI	2007	2009	WV		
MN	2008	2008	WI	2005	2009
MS			WY		
MO	2004	2010			

Table 5. Finance Training in IRLE Summer Institute, by (a) First Year of Attendance; and (b) First Year attendees received Finance Training.

	Control Grp = All Untrained PUCs				Control Grp = Untrained IRLE PUCs			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
$a + b \cdot$ ERP	-0.013	-0.024	-0.02	-0.024	-0.038	-0.051	-0.038	-0.051
	(-0.54)	(-0.98)	(-0.78)	(-0.88)	(-1.20)	(-1.66)	(-1.13)	(-1.52)
FinTrain x ($a + b \cdot$ ERP)	0.003	0.037	0.007	0.029	0.051	0.083	0.047	0.072
	(0.06)	(0.61)	(0.13)	(0.50)	(0.80)	(1.14)	(0.76)	(1.03)
Constant	7.758***	7.742***	8.206***	8.301***	7.857***	7.649***	8.070***	8.093***
	(57.17)	(27.16)	(35.94)	(24.75)	(40.07)	(18.33)	(28.14)	(19.26)
FinTrain	-0.259	-0.410+	-0.252	-0.414+	-0.371	-0.548*	-0.366	-0.537*
	(-1.10)	(-1.78)	(-1.08)	(-1.78)	(-1.40)	(-2.19)	(-1.43)	(-2.25)
Electric	0.204***	0.184***	0.193***	0.171***	0.217***	0.197***	0.216***	0.191***
	(4.80)	(4.17)	(4.60)	(4.03)	(3.89)	(3.26)	(3.85)	(3.21)
ROE		0		-0.001		0.003		0.005
		(-0.18)		(-0.54)		(0.55)		(0.87)
ln(Assets)		0.005		0.006		0.002		0.007
		(0.16)		(0.22)		(0.05)		(0.16)
D/E Ratio		0.012		0.018		0.076*		0.077+
		(0.42)		(0.60)		(2.14)		(1.98)
# of Commissioners			-0.068***	-0.092***			-0.045	-0.066
			(-2.69)	(-3.23)			(-1.34)	(-1.65)
Percentage Elected			-0.950***	-0.854**			-0.994**	-1.267***
			(-3.17)	(-2.42)			(-2.56)	(-3.70)
Percentage Women			0.052	-0.067			0.057	-0.161
			(0.24)	(-0.31)			(0.21)	(-0.67)
Percentage Democrat			-0.016	0.071			0.017	0.023
			(-0.10)	(0.44)			(0.08)	(0.11)
Percentage Republican			-0.012	-0.032			0.177	0.072
			(-0.07)	(-0.17)			(0.98)	(0.38)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.523	0.556	0.534	0.57	0.53	0.553	0.534	0.559
c^2	142.17	123.38	196.94	106.53	106.02	168.88	483.28	1014.28
p-val	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N	840	705	823	699	574	478	574	478
H_A: ($a+b$ERP) + FinTrain x($a+b$ERP) = 1	390.6***	248.3***	421.1***	281.4***	254.8***	158.6***	259.6***	165.9***
H_B: Constant + FinTrain = 0	1565.6***	378.9***	1061.4***	418.1***	1309.9***	200.6***	590***	238.3***
H_C: H_A & H_B	1340.1***	951.6***	532***	221.6***	1438.3***	102.6***	296.6***	120.2***

Table 6 Effects of Finance Training on Rate Setting. Dependent Variable = Permitted ROE spread. Manipulations are reflected in (a) the shift parameter "FinTrain", which equals 1 if the PUC had received an offer of treatment on or before the year of the observed order (and 0 otherwise); and (b) the slope parameter of "FinTrain x Beta x ERP". All Beta computations are Ibbotson adjusted and use Supply-Side Equity Risk Premium. Test statistics for notable CAPM hypotheses are shown in the bottom panel. The left panel uses all non-treated PUC-years as a control, while the right panel limits control group to PUCs seeking treatment at some time. Notation {+, *, **, ***} denotes significance at the {0.10, 0.05, 0.02, 0.01} levels (2-tailed test); t-stats in parentheses. Standard Errors clustered by state.

Sikes 2022 - Regulated Inequity

Regulated Inequity

How regulators' acceptance of flawed financial analysis inflates the profit of public utility companies in the United States

Thomas Sikes, M.S.

January, 2022

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I. Introduction

A critical aspect of public utility regulation is the determination of the allowed return on equity ("ROE") incorporated in rates charged to customers, otherwise known as ratepayers.[1] The awarded ROE is intended to match the utility's cost of equity required to finance its assets. This is one of the more contentious parts of ratemaking as the cost of equity cannot be directly observed and is therefore estimated using financial models. Two landmark cases before the U.S. Supreme Court established standards for a fair rate of return. In *Bluefield*, the Court ruled, "The return should be reasonably sufficient to assure confidence in the financial soundness of the utility and should be adequate, under efficient and economical management, to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties."[2] In *Hope*, the Court affirmed, "[T]he return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital."[3]

The Federal Energy Regulatory Commission ("FERC" or "the Commission"), as the U.S. regulator of interstate transmission of electricity and gas, is bound to the *Bluefield* and *Hope* standards when ruling on the ROE awarded to utilities under its jurisdiction. The methodology FERC uses to determine the ROE is subject to interpretation and has evolved over time. The most recent iteration which established the Commission's techniques for determining the fair

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[1] When an ROE is incorporated into utility rates, it namely involves investor-owned utilities, hence the need to compensate *equity* holders. However, those involved with publicly-owned utilities can take interest in this analysis as lenders to those firms expect a similar overall cost of capital as the IOUs in the form of interest coverage ratios.

[2] *Bluefield Water Works and Improvement Company v. Public Service Commission of West Virginia* (262 U.S. 679) (1923).

[3] *Federal Power Commission et. al. v. Hope Natural Gas Company* (320 U.S. 591) (1944).

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ROE came from Opinion 569-A, issued in May 2020, which found the just and reasonable ROE for the Transmission Owners of the Midcontinent Independent System Operator ("MISO TOs") to be 10.02%.[4] FERC's finding resulted from the application of three financial models used to determine the cost of equity: the Risk Premium methodology, the Discounted Cash Flow ("DCF") model, and the Capital Asset Pricing Model ("CAPM").

The purpose of this paper is to demonstrate that the methodology employed by FERC in Opinion 569 to award the MISO TOs' ROE was biased upwards with the effect of favoring the financial interests of utility shareholders at the expense of ratepayers. The Risk Premium methodology is transparently circular as its result is tautologically dependent on past Commission rulings and can be summarily dismissed. The DCF analysis, although less self-fulfilling than the Risk Premium model, remains significantly biased in that its inputs are inextricably linked to regulatory outcomes. The CAPM is the only approach which can claim to reasonably avoid the circularity issue, although FERC misspecified the model which resulted in it affirming, and even exceeding, the estimates from the self-fulfilling methodologies. Unfortunately, mostly nothing about Opinion 569 could be considered aberrant in the context of utility ratemaking in the United States, whether be it for electric, gas, or water utilities. It is in fact an apt case-study which encompasses the prevailing methodologies used, in one form or another, by utility commissions throughout the nation to determine the ROE. As such, examination of the fallacies behind Opinion 569 reveals in general how regulators' acceptance of flawed financial analysis inflates the profit of public utilities.

[4] *Association of Businesses Advocating Tariff Equity v. Midcontinent Independent System Operator, Inc.*, Opinion No. 569-A, 171 FERC ¶ 61,154 at P 3 (2020).

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Discarding the circular Risk Premium and DCF models and stripping away the biased adjustments to the CAPM reveals a 5.84% just and reasonable cost of equity for the MISO TOs. Utility company witnesses and regulators would almost certainly deride the proposition that the utility cost of equity could be this low. This response, however, would merely reflect the degree of distorted thinking which supports the current framework. After all, the 5.84% estimate results from a standard application of the CAPM, the most widely used model in determining the required rate of return for stocks,[5] and appropriately reflects a discount from the expected return on the overall stock market to account for utilities' low business risk. The principle at stake in ROE proceedings, that public utilities are awarded a fair rate of return on investment when considering their level of risk, cannot credibly claimed to have been upheld when utilities are awarded an ROE that equals, let alone exceeds, the expected return from the overall stock market.

The paper proceeds as follows: Section II covers FERC Opinion 569 with several subsections which address the financial models used to determine FERC's finding on the MISO TOs' cost of equity and explains the 5.84% estimate of the just and reasonable ROE from this analysis. Section III discusses two closely related issues to the determination of the ROE: Capital Structure and ROE incentives, whereby regulators' current approaches can likewise be seen as favoring utility investors at ratepayers' expense. Section IV concludes the analysis.

[5] *Association of Businesses Advocating Tariff Equity v. Midcontinent Independent System Operator, Inc.*, Opinion No. 569, 169 FERC ¶ 61,129 at footnote 501, citing Michael C. Ehrhardt and Eugene F. Brigham, Financial Management: Theory and Practice 253 (13th ed. 2011) ("[T]he basic CAPM is still the most widely used method for thinking about required rates of return on stocks.").

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II. Determining the Base ROE: FERC Opinion 569

A. FERC Opinion 569 Case History

It is worthwhile to review the relevant legal history leading to FERC Opinion 569 for those unfamiliar with the proceedings. For the thirty years prior to FERC Opinion 531 in June 2014, the Commission based the awarded ROE for electric utilities primarily on a DCF methodology which used only short-term earnings projections.[6] In Opinion 531, when determining the ROE for the New England Transmission Owners ("NETOs"), FERC used a "two-step" DCF methodology where both short and long-term earnings projections were considered.[7] On September 28, 2016, FERC issued Opinion 551 in which the Commission adopted the two-step DCF methodology to calculate the just and reasonable ROE for the MISO TOs. As in Opinion 531, FERC found that anomalous capital market conditions had affected the result produced by the mechanical application of the two-step DCF methodology and set the ROE at the central tendency of the upper half of the zone of reasonableness rather than at the midpoint of the zone of reasonableness. As a result, the base ROE of the MISO TOs, previously 12.38%, was reestablished at 10.32%.[8]

On April 14, 2017, the U.S. Court of Appeals – D.C. Circuit in its *Emera Maine* decision vacated and remanded Opinion 531 along with Opinion 551. The D.C. Circuit Court found that the observation that the NETOs' previously existing base ROE differed from the results of the two-step DCF methodology was not sufficient evidence that the ROE was unjust and

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[6] *Coakley Mass. Attorney Gen. v. Bangor Hydro-Elec. Co*., Opinion No. 531, 147 FERC ¶ 61,234, at P 14 (2014).

[7] *Id.* at P 8.

[8] *Association of Businesses Advocating Tariff Equity v. Midcontinent Independent System .Operator, Inc.*, Opinion No. 551, 156 FERC ¶ 61,234 at P 9 (2016).

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unreasonable. Moreover, it was found that the Commission did not adequately justify the decision to set the ROE at the central tendency of the upper half of the zone of reasonableness.[9]

On November 15, 2018, the Commission issued a Briefing Order proposing to address the issues which were remanded in *Emera Maine.* Namely, instead of relying solely on the DCF analysis to determine the ROE, the Commission would consider the results from three additional models, specifically the Expected Earnings methodology, the Risk Premium model, and the CAPM.[10] In Opinion 569, issued on November 21, 2019, FERC disregarded the Expected Earnings and Risk Premium models and used the DCF model and CAPM in its determination, finding the replacement just and reasonable ROE to be 9.88%.[11] Upon rehearing, FERC issued Opinion 569-A on May 21, 2020 and incorporated the Risk Premium model amongst other adjustments, resulting in a just and reasonable ROE of 10.02%.[12]

There are several aspects germane to Opinion 569 which are not addressed in this analysis such as the formation of a sample utility group for purposes of model estimation, the application of outlier tests, whether the ROE should be set at the mean, median, or midpoint of the proxy group estimate, and whether differing weights should be attached across the models used in the final estimate. The focus of this paper is on the spurious application of the standard financial methods rather than discussing issues with such procedural details.

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[9] Opinion No. 569, 169 FERC ¶ 61,129 at PP 7-10 (2019).

[10] *Association of Businesses Advocating Tariff Equity v. Midcontinent Independent System Operator, Inc.*, 165 FERC ¶ 61,118 (2018) (Briefing Order).

[11] *See generally,* Opinion No. 569, 169 FERC ¶ 61,129 (2019). There were two complaints addressed by FERC which resulted in two rulings on the ROE. The First Complaint ("MISO I") was contained in Docket No. EL-14-12-000. Using financial data from January 1 through June 30, 2015, FERC reduced the ROE to 9.88% effective September 28, 2016. The Second Complaint ("MISO II") was contained in Docket No. EL15-45-000. Using financial data from July 1 through December 31, 2015, the Commission found that the 9.88% ROE from MISO I continued to be just and reasonable and awarded no refunds.

[12] Opinion No. 569-A, 171 FERC ¶ 61,154 at P 3 (2020). Similar to Opinion 569, the Commission's finding of a 10.02% base ROE from the First Complaint was not rebutted by the evidence in the Second Complaint.

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B. Expected Earnings

Although FERC in Opinion 569 ultimately rejected the use of the Expected Earnings methodology in determining the MISO TOs' ROE, the discussion of the model's proposed inclusion offers insight into the Commission's conceptual framework. FERC described the model as follows:

> A comparable earnings analysis is a method of calculating the earnings an investor expects to receive on the book value of a particular stock. The analysis can be either backward looking using the company's historical earnings on book value, as reflected on the company's accounting statements, or forward-looking using estimates of earnings on book value, as reflected in analysts' earnings forecasts for the company. The latter approach is often referred to as an "Expected Earnings analysis." The Expected Earnings methodology provides an accounting-based approach that uses investment analyst estimates of return (net earnings) on book value (the equity portion of a company's overall capital, excluding long-term debt).[13] [14]

In application, this methodology merely involves taking the average expected return on shareholders' common equity. In equation form:

$$(1)\ \text{Expected Earnings} = \text{Expected ROE} = \frac{\text{Expected Net Income}}{\text{Expected Common Equity}}$$

To develop its estimate, FERC used the average expected return on common equity from its sample utility group in 2018-2020 as reported in the 2015 issues of the Value Line Investment Survey.[15] Notably, as indicated in Table I, the Expected Earnings model returned the highest estimated just and reasonable ROE of the four proposed models.

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[13] Opinion No. 569, 169 FERC ¶ 61,129 at P 172 (2019).

[14] Footnotes are omitted from intext citations and block quotes where applicable.

[15] Particularly, May 1; May 22 & June 19, 2015. See Trial Staff Initial Br. (I), Attachment A to App. 2 at 13.

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Table I: FERC's Proposed ROE Estimates

Model[16]	Estimate (based on Midpoint except for Risk Premium[17])	
	MISO I	MISO II
CAPM	10.45%	10.49%
DCF	9.52%	9.37%
Expected Earnings	11.18%	11.43%
Risk Premium	10.1%	10.29%

FERC dismissed the Expected Earnings model because of its lack of a market-based measure of price which could measure the opportunity cost of investing in a utility's stock:

> In light of the record in these proceedings as supplemented after issuance of the Briefing Order, we find that there is not sufficient record evidence to conclude that investors rely on the Expected Earnings analysis to estimate the opportunity cost of investing in a particular utility as compared to other companies. As parties have noted, investors cannot purchase equity at book value; therefore, although book value and returns on book equity may be useful data points for investors, they do not reflect an opportunity for investment that can be characterized as an opportunity cost.[18]

Another issue with the Expected Earnings model is its transparent circularity; the anticipated return on equity, the very metric at issue in ROE proceedings, is the single input to the model. In Opinion 551, when justifying the use of the Expected Earnings methodology to

[16] For CAPM, DCF, and Risk Premium results, see Opinion No. 569-A, 171 FERC ¶ 61,154 at Appendix III (2020). For Expected Earnings, see Trial Staff Initial Br. (MISO I), Attachment A to App. 2 at 13 and Trial Staff Initial Br. (MISO II), Attachment A to App. 2 at 13.

[17] Midpoint is the average of the lower and upper end of the zone of reasonableness. In other words, it is the average of the lowest and highest company estimates from the utility proxy group which passed the outlier test. This indeed meant that only two companies informed FERC's estimate for the Expected Earnings, DCF, and CAPM methodologies. The Risk Premium involved a single point estimate; see Section II.C for a review of FERC's Risk Premium methodology.

[18] Opinion No. 569, 169 FERC ¶ 61,129 at P 210 (2019).

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corroborate the placement of the ROE above the midpoint of the zone of reasonableness as determined by the DCF model, FERC acknowledged the presence of circularity in the Comparable Earnings methodology, which is the same procedure as Expected Earnings except that it uses historical book returns rather than projected returns. The Commission cited Dr. Roger Morin's *New Regulatory Finance* where Dr. Morin argued against the inclusion of historical book returns of regulated companies in the Comparable Earnings analysis as "It would be circular to set a fair return based on the past actions of other regulators, much like observing a series of duplicative images in multiple mirrors."[19] FERC, however, argued that it mitigated the problem of circularity because the Expected Earnings model uses *forward* estimates of the ROE:

> Dr. Morin's recommendation to avoid other utilities in the sample is based on his concern that the use of historical book ROE would be based on past actions of regulatory commissions and, therefore, reliance on those past actions to set an ROE would raise issues of circularity. However, MISO TOs' expected earnings analysis is forward-looking and based on Value Line forecasts, adjusted to reflect each utility's average return. As the Commission explained in Opinion No. 531-B, an expected earnings analysis, in contrast to a comparable earnings analysis, is sound when it is forward-looking and based on a reliable source of earnings data.[20]

Expectations of future earnings for regulated firms are, of course, inseparable from the expected rate of profit awarded by regulators. As the MISO Complainant-Aligned Parties ("MISO CAPs") explained in their rebuttal testimony:

> As MISO CAPs witness Mr. Solomon explains in his Rebuttal Affidavit, placing reliance on Value Line's projected, or forward-looking, accounting returns on book value does not avoid the undeniable issue of circularity. Value Line's projections for regulated utilities are grounded in existing and expected ROEs

[19] Opinion No. 551, 156 FERC ¶ 61,234 at P 231 (2016) citing Morin, Roger A., *New Regulatory Finance* (Public Utilities Reports, Inc. 2006), 383.

[20] *Association of Businesses Advocating Tariff Equity v. Midcontinent Independent System Operator, Inc.*, Opinion No. 551, 156 FERC ¶ 61,234 at P 231 (2016). The Commission used the MISO TOs' Expected Earnings analysis to corroborate the finding that the ROE should be placed above the midpoint of the zone of reasonableness determined by the DCF model.

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> awarded by the Commission and state commissions, as applicable. Value Line reports, therefore, do not provide projections of future authorized ROEs; instead, the past allowed ROEs provide the basis for future earnings.[21]

In other words, the idea that using a "forward-looking" estimate of future profit for regulated firms somehow ameliorates the self-perpetuating nature of the Expected Earnings model is erroneous given the tautological relationship between the awarded ROE and the expectation of the future ROE; the regulator simply sets the rate of profit which can be expected in future periods. FERC did not address the MISO CAPs' comments on the circularity issue for the Expected Earnings model in Opinion 569. Nonetheless, when the rubber met the road, it is apparent that whatever the Commission held to be "sound" about the Expected Earnings methodology in Opinion 551 was not enough to justify the model's inclusion in determining the ROE in Opinion 569:

> The Commission stated that "The expected earnings analysis, like the other alternative methodologies accepted herein, is merely used as corroborative evidence... which at most can corroborate the Commission's decision to place an ROE above the midpoint of the zone of reasonableness." Here, the question before the Commission is whether to adopt the proposal in the Briefing Order to directly use the results of the Expected Earnings model in the ROE estimate calculations that are the foundation of our ROE analysis. We find that stronger evidence is required to support a decision to include the Expected Earnings model as a direct input in our ROE methodology than is required to merely use it as corroborative evidence for placing an ROE within the zone of reasonableness.[22]

Another revealing aspect of the Expected Earnings adjudication involved the discussion of the market-to-book ("M/B") ratios for the sample utility companies whose financial data was used for model estimation. Dr. J. Randall Woolridge, in his testimony on behalf of the State Complainants in the dockets pertaining to Opinion 531, provided a succinct explanation of the

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[21] Reply Paper Hearing Brief of the MISO Complainant-Aligned Parties in Docket No. EL14-12-003 at 38.

[22] Opinion No. 569, 169 FERC ¶ 61,129 at P 226 (2019).

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relationship between the M/B ratio and ROE along with the following graphic (where "K" indicates the cost of equity):

> [T]he relationship between a firm's return on equity, cost of equity, and market-to-book ratio is relatively straightforward. A firm that earns a return on equity above its cost of equity will see its common stock sell at a price above its book value. Conversely, a firm that earns a return on equity below its cost of equity will see its common stock sell at a price below its book value.[23]

Profitability	**Value**
If ROE > K	then Market/Book > 1
If ROE = K	then Market/Book = 1
If ROE < K	then Market/Book < 1

It follows that utility M/B ratios greater than 1.0 provide evidence that their earnings exceed their cost of capital because of excessive ROEs. Mr. J. Bertram Solomon, in his testimony on behalf of the Joint Complainants and Intervenor in the docket pertaining to Opinion 569, demonstrated that this situation characterized the sample utility firms. As he showed using data from the Value Line Investment Survey, there was a positive linear relationship between the utilities' M/B ratios and their expected ROEs. Additionally, the M/B ratios were clearly above 1.0 with an average of 1.80.[24] This statistically significant model notably predicts that an expected ROE of 7.01% results in an M/B ratio of 1.0.[25]

[23] Testimony of Dr. Randall Woolridge in Docket Nos. EL11-66-000 & EL11-66-000 at 13-14.

[24] Testimony of J. Bertram Solomon in Docket No. EL14-12-002 at Exhibit No. JCI-105.

[25] That is, reverse the roles of x & y in the displayed equation, set y = 1 and solve for x.

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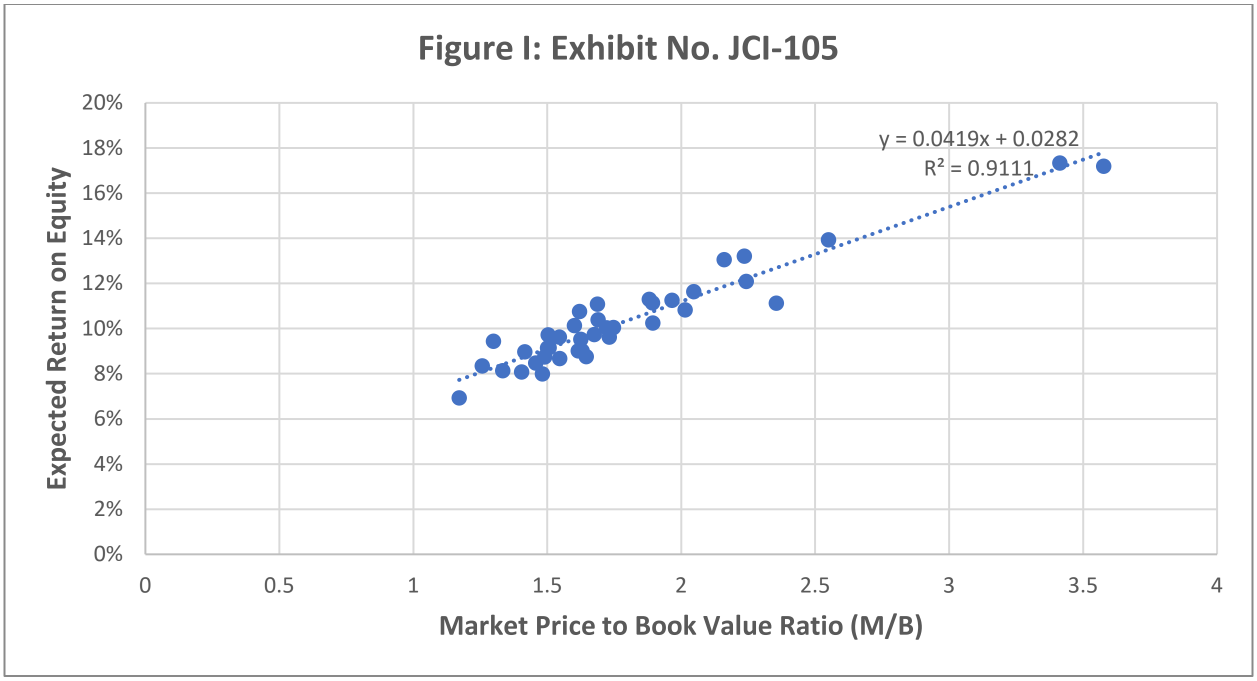

FERC rightly acknowledged the fundamental link between the awarded ROE and the market price of a utility's stock when rejecting the MISO TOs' rationale for incorporating the Expected Earnings methodology in determining the ROE:

> The MISO TOs' concerns about market-to-book ratios in excess of one and maintaining the current stock values of public utilities do not justify use of the Expected Earnings model. The Commission is not obligated to set ROEs so as to maintain current stock values. As the Supreme Court held in *Hope*, the "fair value" of a regulated enterprise "is the end product of the process of ratemaking, not the starting point . . . The heart of the matter is that rates cannot be made to depend on 'fair value' when the value of the going enterprise depends upon earnings under whatever rates are anticipated." Consistent with this holding in *Hope*, the Commission has stated, "The market value of an enterprise or its common stock depends upon its earnings or anticipated earnings, which in turn depend upon the rates allowed. Thus, market value is the result of the ratemaking process and may not properly be the beginning of that process as well.[26]

The Commission, however, disavowed that ROE policy should be set so that utilities' M/B ratios are driven towards 1.0:

[26] Opinion No. 569, 169 FERC ¶ 61,129 at P 207 (2019).

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> We recognize that, in an environment where the market-to-book ratios of publicly-traded companies are generally above one, it would be unreasonable to adopt an ROE policy that resulted in capital losses for investors in order to drive market-to-book ratios that are currently above one down to one.[27]

Dr. William E. Avera, in his testimony on behalf the MISO TOs in the docket pertaining to Opinion 551, provided the following warning against the complainants' proposed ROEs:

> [T]he cuts to the Base ROE urged by the Opposing Witnesses range from a minimum of 284 basis points to over 350 basis points… The ability of the MISO Transmission Owners to attract and retain capital could be severely compromised, leading investors to view the Commission's regulatory framework as unstable. This would have a long-term, chilling effect on investors' willingness to support future expansion of electric transmission and related infrastructure…[28]

It is difficult to square such alarmism with awarded rates of profit that allowed utility equity to trade, on average, at almost twice the accounting value of the underlying assets. That is, there should not be an issue with lowering the ROE if utilities maintain an M/B ratio greater than or equal to 1.0 as this indicates that the utility earns enough to finance its rate base.[29]

In *New Regulatory Finance*, Dr. Morin attempted to refute the argument that M/B ratios above 1.0 were evidentiary of excessive ROEs:

> The inference that M/B ratios are relevant and that regulators should set an ROE so as to produce an M/B of 1.0 is misguided. The stock price is set by the market, not by regulators. The M/B ratio is the end result of regulation, and not its starting point. The view that regulation should set an allowed rate of return so as to produce an M/B of 1.0 presumes that investors are irrational. They commit capital to a utility with an M/B in excess of 1.0, knowing full well that they will be inflicted a capital loss by regulators. This is certainly not a realistic or accurate view of regulation. For example, assume a utility company with an M/B ratio of 1.5. If investors expect the regulator to authorize a return on book value equal to

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[27] *Id.* at P 208.

[28] Answering Testimony of William E. Avera, PHD, CFA on Behalf of The MISO Transmission Owners in Docket No. EL14-12-002 at 20-21.

[29] David C. Parcell, in *The Cost of Capital – A Practitioner's Guide* (2020, 12), indicated that the Original Cost method is primarily used to determine the rate base, stating, "[Original Cost] is the prevalent measurement technique over the past several decades and reflects the purchase price of plant and equipment net of accumulated depreciation. Original cost is consistent with **accounting values**." Emphasis appears as it is in the source text.

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> the DCF cost of equity, the utility stock price would decline to book value, inflicting a capital loss of some 30%. The notion that investors are willing to pay a price of 1.5 times book value only to see the market value of their investment drop by 30% is irrational.[30]

This reasoning misrepresents the significance of M/B ratios in informing the cost of equity, specifically by failing to differentiate between the outcomes of new and existing investors. If the regulator were to set the ROE at a lower rate than previously anticipated by the market, there would obviously be an attendant decrease in the share price. However, with the new ROE known by the market, *new* investors who commit *incremental* capital would not be exposed to a capital loss because the decreased stock price already reflects the expectation of lower profits. The issue is whether the price at which new investors offer their capital is sufficient to cover the utility's required investments; an M/B ratio greater than or equal to 1.0 supports that this criterion is met. It is nonetheless true that existing shareholders will incur a capital loss given that they bought the stock when the regulator was expected to award a higher ROE. However, the goal of ROE proceedings is to ensure that a *fair* rate of return is authorized, not to underwrite existing stock prices. As previously noted, FERC stated "The Commission is not obligated to set ROEs so as to maintain current stock values".

Dr. Morin further inveighed against the role of M/B ratios:

> In an inflationary period, the replacement cost of a firm's assets may increase more rapidly than its book equity. To avoid the resulting economic confiscation of shareholders' investment in real terms, the allowed rate of return should produce an M/B ratio which provides a Q-ratio of 1 or a Q-ratio equal to that of comparable firms. It is quite plausible and likely that M/B ratios will exceed one if inflation increases the replacement cost of a firm's assets at a faster pace than historical cost (book equity). Perhaps this explains in part why utility M/B ratios have remained well above 1.0 over the past two decades. Are we to conclude that regulators have been systematically misguided all across the United States for all these years by awarding overgenerous returns, or are we to conclude that M/B

[30] Morin, *New Regulatory Finance*, 376.

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> ratios are largely immaterial in the context of ratemaking? The latter is more likely.[31]

It is indeed the contention of this analysis that the former accurately describes the present situation. To wit, it's unlikely that inflation could have explained the observed M/B ratios when considering, under the predominant methodology of Cost-of-Service regulation, that utility revenue requirements are set so the cost of prudently incurred investment is recovered through rates. It would be unfortunate for ratepayers if inflation caused the replacement cost of the utility's assets, and thereby the revenue requirement, to rise higher than expected, but this is not reason to believe that regulators will prevent the cost recovery of legitimate business expenses. Moreover, it is implausible that replacement costs which are greater than historical book costs could result in "economic confiscation" as the cost of incremental capital is rolled into the rate base and shareholders are allowed a rate of return on the higher-priced invested capital.

In the late 1970s/early1980s, when inflation and interest rates were at record highs, M/B ratios figured more prominently in informing regulation. As Kihm et al. (2015) explained:

> While utilities today have incentives to invest, such was not always the case. In the early 1980s authorized rates of return for utilities were in the 13 to 15 percent range, with earned returns being closer to 10 to 12 percent. The cost of debt (which is lower than the cost of equity) reached levels in excess of 16 percent. Utility stock prices traded as low as half of their underlying book values.
>
> Clearly, the return on equity was less than the cost of equity during this period, creating a disincentive for utilities to make investments. Under these conditions, every dollar the utilities invested tended to increase profits (which depends only on having a positive *r*), but it also caused their stock prices to decline (because *r* was less than *k*). At the time, this raised concerns that rose all the way to Congress about a bias *against* utility investment and led to debate about the possibility of Federal intervention to remedy the problem.[32]

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[31] Morin, *New Regulatory Finance*, 377-378. On page 371, the Q-ratio is defined as Q = Market Value of a Firm's Securities / Replacement Cost of a Firm's Assets.

[32] Steve Kihm, Ron Lehr, Sonia Aggarwal, and Edward Burgess, "You Get What You Pay For: Moving Toward Value in Utility Compensation" (June 2015) at 12-13. Available at https://docs.cpuc.ca.gov/PublishedDocs/Efile.

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Dr. Morin also emphasized how low market-to-book ratios demonstrated utilities' deteriorating financial health during this period:

> The depressing effect of inflation on utility earnings, dividend, and book value growth was compounded by the necessity to sell stock at prices below book value, which diluted book value and retarded growth further… The utility industry experienced a turnaround in the early 1980s. Inflation abated, utilities were authorized and were earning higher rates of return than in earlier years, and market-to-book ratios increased, so that stock sales no longer diluted book value to the same extent they did earlier.[33]

When considering the foregoing, a pattern becomes apparent whereby M/B ratios below 1.0 indicate that utilities are in a precarious state as they earn below their cost of capital and are used as a justification to raise rates. On the other hand, when the ratio is above 1.0 it is considered insignificant in informing the fair rate of return. Given that M/B ratios signaled regulators to raise ROEs when below 1.0 and that this metric has been consistently above 1.0 since the 1980s,[34] it should be expected that commissions, assuming they were even-handed in their treatment, would consider M/B ratios above 1.0 as indicative of excessive ROEs. Unfortunately, as mentioned beforehand, FERC dismissed this evidence because non-utility stocks are commonly found to trade above their book value. The Commission, however, did not reflect on the appropriateness of comparing the M/B ratios of regulated utilities to the rest of the stock market. Indeed, invoking the high stock price relative to book value of the general stock market as a rationale for dismissing the importance of utility M/B ratios diminishes the credibility of FERC's assertion that it is *not* setting ROE policy so as to maintain share prices.

[33] Morin, *New Regulatory Finance*, 293.

[34] As explained by FERC, "In fact, market-to-book ratios of the proxy companies have been consistently above one since the 1980s, a period during which the Commission solely used the DCF model to determine ROEs." Opinion No. 569, 169 FERC ¶ 61,129 at P 208 (2019).

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The argument that M/B ratios are relevant information, however, should not be taken to mean that commissions should rely exclusively on this metric to determine the cost of equity. For one, the use of a proxy group of publicly traded utilities for model estimation, including the group which FERC relied on in Opinion 569, contains nonregulated business which can distort the estimated cost of equity, although this bias applies for the DCF model and CAPM as well. Nonetheless, it would be fair to view M/B ratios as, in the parlance of ROE proceedings, "corroborative" in the sense that the metric informs the efficacy of regulators' approach to setting the allowed rate of return, with M/B ratios greater than 1.0 as indicative that utilities have been allowed to earn more than their cost of equity. At times, an outlier well above (or below) 1.0 might be the result of transient fluctuations in financial markets or a sample issue where the metric is unduly influenced by non-utility business. However, given that M/B ratios have held well above 1.0 for more than three decades, it's unlikely that high M/B ratios could have resulted from such vagaries; regulators have simply allowed a rate of profit that has inflated the market price beyond what is necessary to fund utility assets.

C. Risk Premium

Unlike Expected Earnings, FERC ultimately incorporated the Risk Premium methodology into its determination of the MISO TOs' ROE. The Commission provided the following rationale for the model:

> The risk premium methodology, in which intenrest rates are also a direct input, is "based on the simple idea that since investors in stocks take greater risk than investors in bonds, the former expect to earn a return on a stock investment that reflects a 'premium' over and above the return they expect to earn on a bond investment."[35]

[35] Opinion No. 569, 169 FERC ¶ 61,129 at P 304 (2019).

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FERC initially rejected this methodology in Opinion 569 issued in November 2019. However, the Commission reversed course in Opinion 569-A, issued in May 2020, when it included the results from the Rish Premium model in its ruling. As shown in Table I, the ROE estimated from this methodology was higher than the DCF result, so its inclusion had the effect of increasing the ROE awarded from the prior ruling.

As explained by FERC, the basic approach of the Risk Premium methodology is to add a risk premium to the observed cost of debt to compensate equity holders for the incremental risk from investing in a company's stock rather than its bonds. In formula form:

$$(2)\ \text{ROE} = \text{Cost of Debt} + \text{Risk Premium}$$

In FERC's application of the model, the cost of debt was represented by the Baa Utility Bond Yield as reported by Moody's Investors Service. An Implied Risk Premium was determined by subtracting the bond yield from a contemporaneous FERC ruling on the ROE. The Average Risk Premium was computed by averaging over a study period of 71 observations on the Implied Risk Premium from February 2006 to June 2015. The Average Risk Premium was then adjusted to account for the supposed inverse relationship between bond yields and equity risk premia; the adjustment factor added 0.70% to the Average Risk Premium for every 1% decrease between the Baa Utility Bond Yield over the study period and the yield as of June 2015. The awarded ROE was finally determined by adding the Baa Utility Bond Yield as of June 2015 to the Adjusted Risk Premium. A formulaic description of FERC's methodology is as follows:[36]

$$3)\ \text{ROE} = \text{June 2015 Baa Utility Bond Yield} + \text{Adjusted Equity Risk Premium}$$

Where:

$$\text{Adjusted Equity Risk Premium} = \text{Avg. Risk Premium over Study Period} + \text{Adjustment to Avg. Risk}$$

[36] See MISO I results at Opinion No. 569-A, 171 FERC ¶ 61,154 Appendix I (2020). For convenience, FERC's Risk Premium inputs and results are provided in Exhibit I of the Appendix.

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And where:

$$\text{Avg. Risk Premium over Study Period} = \text{Avg. Base ROE} - \text{Avg. Baa Utility Bond Yield}$$

$$\text{Adjustment} = \text{B} * (\text{June 2015 Baa Utility Bond Yield} - \text{Avg. Baa Utility Bond Yield})$$

$$\text{B} = \text{Risk Premium/Interest Rate Relationship}$$

Plugging the MISO I results into the above formulation:

$$10.10\% = \underbrace{4.65\%}_{\text{June 2015 Baa Yield}} + \overbrace{(10.53 - 6.10\%)}^{\text{Avg. Risk Premium over Study Period}} + (\underbrace{-0.7006) * (4.65\% - 6.10\%)}_{\text{Adjustment to Avg. Risk}}$$

Combining yield components and simplifying:

$$10.10\% = \underbrace{10.53\%}_{\text{Avg. Base ROE}} + (4.\underbrace{65\% - 6.10\%) + (-0.7006) * (4.65\% - 6.10\%}_{\text{Sum of Yield Components}})$$

$$10.10\% = 10.53\% - 1.45\% + 1.02\%$$

$$10.10\% = 10.53\% - 0.43\%$$

As shown above, the Adjustment to Average Risk mitigated the difference between the June 2015 and average study period yield so that the impact of the yield terms was minimal; the outcome overwhelmingly resulted from the Average Base ROE which represented FERC's past rulings on the allowed ROE. Notably, as the Risk Premium/Interest Rate Relationship approaches -1, the difference between the result of the Risk Premium model and FERC's historically awarded ROE is virtually eliminated. It's unfortunate that the circularity of the Risk Premium methodology is hidden beneath jargon like the "Implied Cost of Equity" and "Risk Premium/Interest Rate Relationship", but once the equation is broken out into its components, no reasonable person could deny that the model is principally informed by the Commission's past ROE determinations. As with the Expected Earnings model, a tautological relationship occurs

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where the impending ROE is determined by past regulatory decisions, although under the Risk Premium approach there is a modest interest rate adjustment which is practically muted by the Adjustment to Average Risk.

FERC itself acknowledged the self-fulfilling nature of the Risk Premium model in Opinion 569:

> While all models, including the DCF, feature some circularity, such circularity is particularly direct and acute with the Risk Premium model because it directly relies on past Commission ROE decisions. MISO TOs' regression analysis, discussed below, accentuates such circularity by largely offsetting the effects of changes in interest rates. As a result, we share the concerns expressed by various parties that the circularity inherent in the Risk Premium model's use of prior ROE determinations would largely continue previously-approved ROEs and reflect past circumstances that influenced the previous ROE decisions.[37]

The Commission, however, ruled differently in Opinion 569-A:

> The Commission, in Opinion No. 569, found that the Risk Premium model contained substantial circularity. Upon reconsideration, we agree with MISO TOs and find that, while it contains some circularity, the averaging of the results with those of the DCF and CAPM models sufficiently mitigates that circularity. Additionally, all of the models contain some circularity. And, upon consideration of the rehearing requests, we believe that the level of circularity in the Risk Premium model is acceptable.[38]

It is hard to view FERC's reasoning in the later ruling as anything other than arbitrary and capricious. How can it be that averaging the results of a flawed model with two presumably less-defective models "mitigates" the problems associated with the former model? If the Risk Premium methodology were itself meritorious, FERC should have demonstrated as such without resorting to the conjecture that averaging the model with the DCF and CAPM somehow ameliorates its circularity. Furthermore, the Commission gave no objective standard by which to

[37] Opinion No. 569, 169 FERC ¶ 61,129 at P 343 (2019).

[38] Opinion No. 569-A, 171 FERC ¶ 61,154 at P 106 (2020).

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judge how a circular model might be considered "acceptable". Apparently, FERC's beliefs alone are enough to determine if an admittedly flawed methodology can be used to award the ROE.

Although the circularity problem renders the Risk Premium model meaningless, except for purposes of anchoring the Commission's decision on past rulings, FERC's Adjustment to Average Risk deserves further scrutiny as it functions to further inflate the ROE. The thinking behind the adjustment is that changes in interest rates are inversely related to changes in risk premia. Dr. Morin offered the following support for such an adjustment:

> Published studies by Brigham, Shome, and Vinson (1985), Harris (1986), Harris and Marston (1992, 1993), Carleton, Chambers, and Lakonishok (1983), Morin (2005), and McShane (2005), and others demonstrate that, beginning in 1980, risk premiums varied inversely with the level of interest rates – rising when rates fell and declining when interest rates rose.[39]

FERC's approach in Opinion 569-A was to measure this relationship by regressing the Implied Risk Premium on the Baa Utility Bond Yield. The below graph illustrates the regression which was the basis of the inverse Risk Premium/Interest Rate Relationship:

[39] Morin, *New Regulatory Finance*, 128. The criticism of the Risk Premium methodology discussed herein similarly applies to the studies listed.

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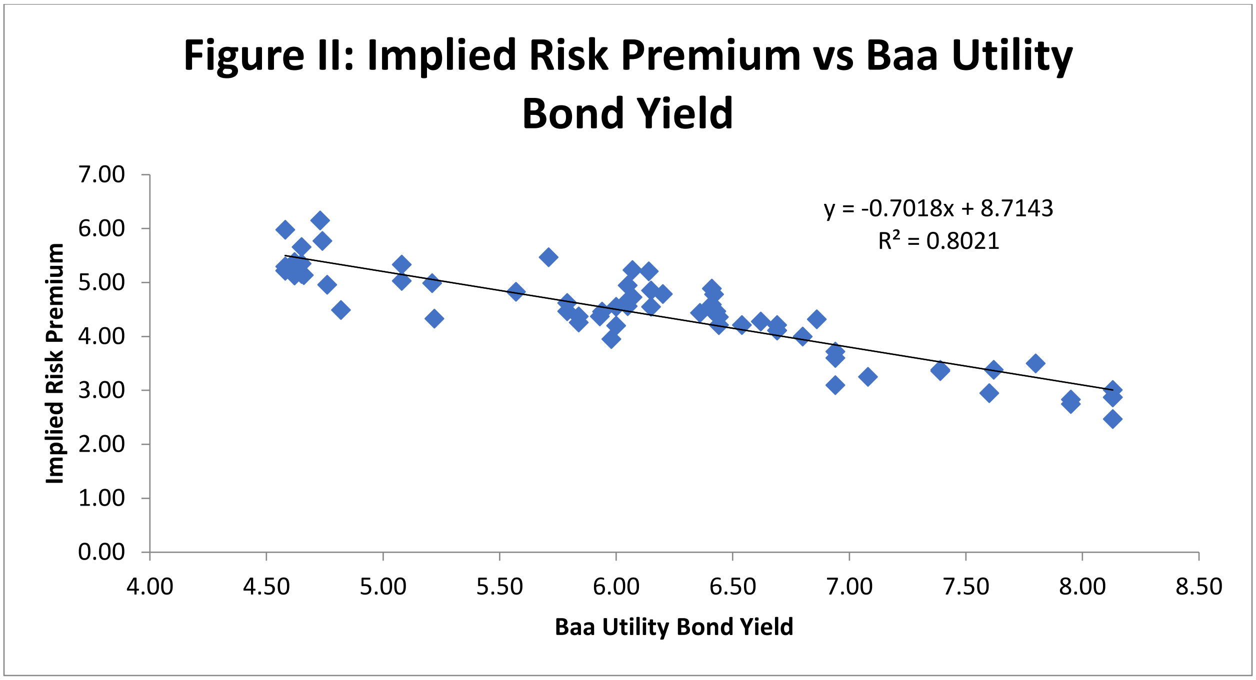

Considering FERC's instrumental role in determining the Implied Risk Premium as it ruled on the awarded Base ROE and given the circularity of its various approaches to determining the Base ROE, as the Commission itself acknowledged, it should not be a surprise that the regression analysis produced the presupposed result. As FERC affixes the Base ROE to its past rulings while the Baa Utility Bond Yield fluctuates due to prevailing market interest rates, it's obvious that as yields fall the Implied Risk Premium will rise and vice-versa. Figure III provides a time series plot of FERC's Risk Premium data where the inverse pattern is clearly produced by the stationarity of FERC's Base ROE while the Baa Utility Bond Yield fluctuates:[40]

[40] See Exhibit I of the Appendix for FERC's Risk Premium model inputs.

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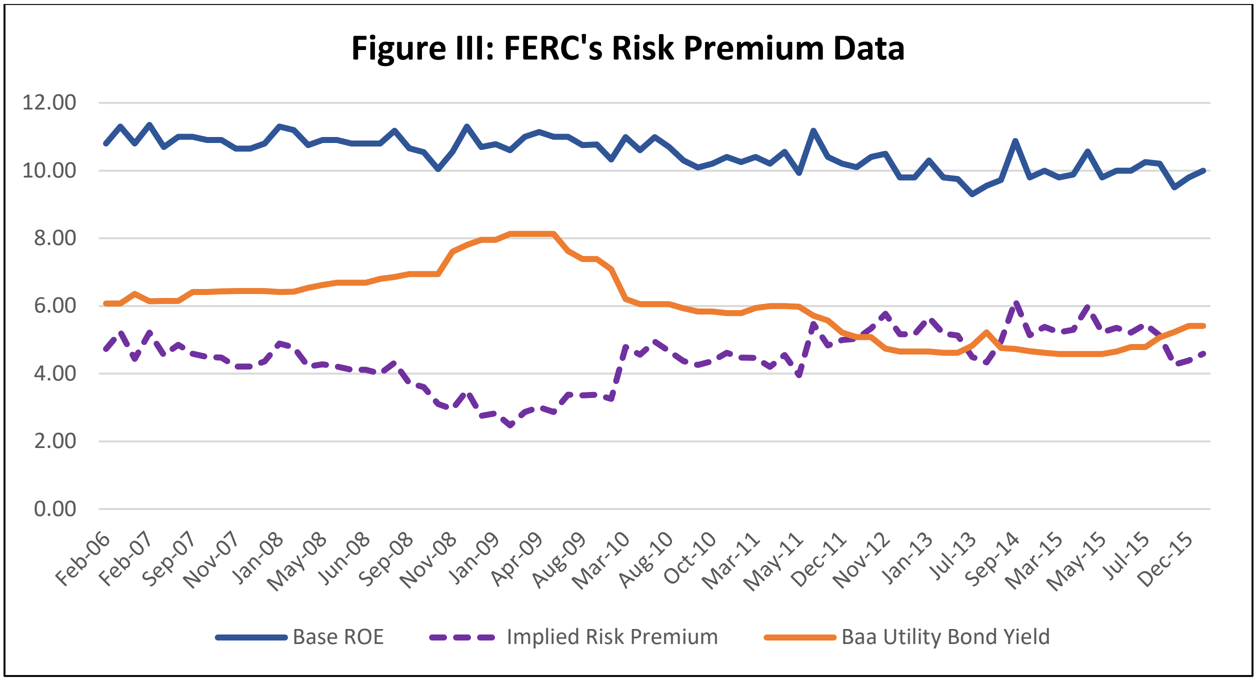

Figure III: FERC's Risk Premium Data

It should be noted that the complainant parties criticized the circularity of the Risk Premium methodology. The Louisiana Public Service Commission highlighted the absurdity of FERC's approach in the following analogy:

> Obviously, if the ROE barely moves, the risk premium will change as the bond yield changes, if the risk premium is defined as the difference between the ROE and the same bond yield. Simple arithmetic produces this result. That would be even more true and statistically significant if the ROE did not change at all. For instance, assume a flag pole outside FERC is 11 feet tall. A "Flagpole Premium" could be computed as the difference between 11 and the annual bond yield. If the results were then plotted, the *fit would be perfect*.[41]

Mr. Michael P. Gorman of the Joint Complainants also questioned the validity of the alleged inverse relationship and noted increased risk premiums during the financial crisis years:

> During the 2007-2010 period, the market paid premiums for low-risk U.S. Treasury securities and demanded higher returns for securities of greater risk. This is evident because the spread between Baa bond yields, a riskier investment than A-rated bonds, and a U.S. Treasury bond, widened during this period. Hence, the market priced higher risk premiums in securities during this time period…

[41] Brief on Behalf of the Louisiana Public Service Commission in Docket No. EL14-12-003 at 33.

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> Importantly, these changes in risk premiums are not driven by interest rate changes alone, but rather are impacted by the market's willingness to accept risk, and the risk premiums demanded for higher risk securities.[42]

Indeed, that the trough of the Implied Risk Premium occurred in late 2008/early 2009 casts doubt on the validity of FERC's approach. Contrary to the Commission's findings, it seems likely that the market would have attached a relatively high premium to more risky securities during this episode of volatility. Damodaran (2021) corroborated the view that the implied equity risk premium increased during this time-period:

> During 2008, the S&P 500 lost just over a third of its value and ended the year at 903.25 and the treasury bond rate plummeted to close at 2.21% on December 31, 2008. Firms also pulled back on stock buybacks and financial service firms in particular cut dividends during the year. The inputs to the equity risk premium computation reflect these changes…
>
> The implied premium rose more than 2%, from 4.37% to 6.43%, over the course of the year, indicating that investors perceived more risk in equities at the end of the year, than they did at the start and were demanding a higher premium to compensate.[43]

In light of the foregoing evidence, it's implausible that FERC's Implied Risk Premium could be considered an objective assessment of the true market risk premium over the study period. The Commission's approach led to the spurious conclusion on the inverse Risk Premium/Interest Rate Relationship which unfairly adjusted the estimated cost of equity upwards. Although the Adjustment to Average Risk raised the Risk Premium estimate by 102 basis points, it's important not to forget that the main problem with the model is its overwhelming reliance on the Commission's past decisions. Nonetheless, the inclusion of such

[42] Affidavit of Michael P. Gorman on behalf of Joint Complainants in Docket No. EL14-12-003 at 33-34.

[43] Aswath Damodaran, "Equity Risk Premiums (ERP): Determinants, Estimation, and Implications – The 2021 Edition" (March 23, 2021). Available at SSRN: https://ssrn.com/abstract=3825823, 86-88.

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an unfounded adjustment further underscores the pervasiveness of self-fulfilling logic and generally flawed analysis in the Commission's awarding of the ROE.

D. Discounted Cash Flow

FERC also used the DCF model in its determination of the awarded ROE. The Commission provided the following description:

> The DCF model is based on the premise that an investment in common stock is worth the present value of the infinite stream of dividends discounted at a market rate commensurate with the investment's risk.[44]

This is represented by the following formula:

$$P_0 = \frac{D_1}{(1+k_1)} + \frac{D_2}{(1+k_2)^2} + \cdots + \frac{D_n}{(1+k_n)^n}$$

where: P_0 = current stock price
D_1 = dividends paid in year 1
k_1 = discount rate/investors' required rate of return in year 1
n = infinity

It can be shown that if dividends grow from period-to-period at a constant growth rate, g, then the model reduces to the following:

$$(4) \quad P_0 = \frac{D_1}{k - g}$$

where: P_0 = current stock price
D_1 = dividends paid in year 1
k = discount rate/investors' required rate of return
g = expected growth rate of dividends

Solving for k indicates the required rate of return:

$$(5) \quad k = \frac{D_1}{P_0} + g$$

[44] Opinion No. 569, 169 FERC ¶ 61,129 at P 87 (2019).

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Thus, the required rate of return or cost of equity can be determined when given values for the parameters on the right-hand side of equation (5). The D_1/P_0 term is oftentimes referred to as the "dividend-yield". The current stock price, P_0, is widely available from public data sources. As D_1 exists in the future, it is not directly observed and must be estimated. FERC used the following approach in Opinion 569:

> The Commission also multiplies the dividend yield by the expression (1+.5g) to account for the fact that dividends are paid on a quarterly basis. Multiplying the dividend yield by (1+.5g) increases the dividend yield by one half of the growth rate and produces what the Commission refers to as the "adjusted dividend yield." Under the resulting formula, ROE equals the adjusted dividend yield plus the expected future growth rate of dividends and can be expressed as follows:
>
> $k=D/P\ (1+.5g) + g.$[45] [46]

Moreover, it is important to keep in mind that FERC derived its DCF estimate using a group of sample utilities. This is common practice so that the result is not unduly influenced by the vagaries of a sole company's financial data.

As is often the case when the DCF model is litigated in an ROE proceeding, there was disagreement on the expected growth rate of dividends. For the 30 years prior to when Opinion 531 was issued in June 2014, FERC only considered short-term earnings forecasts in its estimation of g. In Opinion 531, to determine g, the Commission adopted the "two-step" DCF methodology which it described as follows:

> Security analysts' five-year forecasts for each company in the proxy group, as published by the Institutional Brokers Estimate System (IBES), are used for determining growth for the short term; earnings forecasts made by investment analysts are considered to be the best available estimates of short-term dividend

[45] *Id.* at P 88.

[46] In Opinion 531, FERC provided further explanation on the calculation of the dividend-yield, "[The two-step DCF] methodology derives a single dividend yield for each proxy group company, using a three step process: (1) averaging the high and low stock prices as reported by the New York Stock Exchange or NASDAQ for each of the six months in the study period; (2) dividing the company's indicated annual dividend for each of those months by its average stock price for each month (resulting in a monthly dividend yield for each month of the study period); and (3) averaging those monthly dividend yields." Opinion No. 531, 147 FERC ¶ 61,234, at P 77 (2014).

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> growth because they are likely relied on by investors when making their investment decisions. Long-term growth is based on forecasts of long-term growth of the economy as a whole, as reflected in GDP. The short-term forecast receives a two-thirds weighting and the long-term forecast receives a one-third weighting in calculating the growth rate in the DCF model.[47]

In the dockets pertaining to Opinion 569, the MISO TOs contended for using only the short-term earnings projections for the estimate of g while the various complainants argued to incorporate the long-run component, unsurprisingly as the former growth rate is generally higher. FERC adopted the two-step methodology in Opinion 569, although ultimately in Opinion 569-A the Commission assigned an 80% weighting to the short-term component and 20% to the long-term component, concluding that lower short-term earnings forecasts for utilities made the projection more sustainable than when the two-thirds weight was established for oil and natural gas companies in the 1990s.[48]

As the reader has likely surmised, there are more fundamental problems with using the DCF model as the basis for awarding a fair rate of return than what to use as the constant growth rate of dividends. Namely, the dividend paid by utilities in the forthcoming period and the expected growth rate of utility earnings are inextricably linked to the ROE awarded by regulators. Mr. Adrien M. McKenzie, in his reply affidavit on behalf of the MISO TOs when testifying in favor of the Expected Earnings methodology, provided an accurate assessment on the circularity of the DCF model, even if somewhat unintentionally:

> Moreover, given the importance of the return on equity component of a utility's revenue requirements, virtually every measure of future financial performance—including cash flow measures, profitability, and dividend policies—is impacted by the ROE established by regulators. As a result, the projections of earned returns used to apply the Expected Earnings approach are no more susceptible to concerns over regulatory influence (past, present, or future) than the analysts' EPS growth rates reported by IBES. If analysts' estimates are rendered unusable

[47] Opinion No. 531, 147 FERC ¶ 61,234, at P 17 (2014).

[48] Opinion No. 569-A, 171 FERC ¶ 61,154 at P 57-58 (2020).

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> because they are, in part, a function of expectations regarding future allowed ROEs, under Dr. Berry's and the LPSC's own logic, the DCF model must be rejected as well. This is misguided and the Commission should dismiss such arguments.[49]

Mr. McKenzie said nothing further about why it would be "misguided" to dismiss the DCF model on the same basis which invalidated the Expected Earnings model. His reasoning was likely meant to appeal to the sanctity of the Commission's historically preferred approach to awarding the ROE. After all, implicit in FERC's acceptance of the DCF analysis for over thirty years is that expectations formed upon regulators' decisions are a legitimate basis for determining the ROE in impending rate cases. From this perspective, it's sensible to equate the applicability of the Expected Earnings model with the DCF model. The problem with Mr. McKenzie's reasoning, however, was that neither methodology should have ever been considered justified. In truth, the Commission's judgement on the Expected Earnings methodology similarly applies to the DCF model. As seen in equation (4), the presence of the market value of utility stock, P_0, which "depends upon its earnings or anticipated earnings, which in turn depend upon the rates allowed",[50] makes the DCF model fundamentally endogenous; the market valuation P_0, nor the parameters D_1 or g, simply cannot be separated from the anticipated ROE awarded by regulators. Given that P_0, D_1, and g result from regulation, solving for k merely reflects the outcome of said regulation.

Dr. Morin attempted a defense against the circularity criticism:

> The circularity problem is somewhat dampened by the self-correcting nature of the DCF model. If a high equity return is granted, the stock price will increase in response to the unanticipated favorable return allowance, lowering the dividend yield component of market return in compensation for the high g induced by the high allowed return. At the next regulatory hearing, more conservative forecasts

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[49] Reply Affidavit of Adrien M. McKenzie, CFA on behalf of the MISO Transmission Owners in Docket Nos. EL14-12-000 & EL15-45-000 at 72.

[50] Opinion No. 569, 169 FERC ¶ 61,129 at P 207 (2019).

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> of r would prevail. The impact on the dual components of the DCF formula, yield and growth, are at least partially offsetting.[51]

Dr. Morin nonetheless acknowledged the circularity issue in the following passage:

> One of the leading experts on regulation, Dr. C. F. Phillips, discussed the dangers of relying on the DCF model:
>
>> [T]here remains the circularity problem: Since regulation establishes a level of authorized earnings which, in turn, implicitly influences dividends per share, estimation of the growth rate from such data is an inherently circular process. For all of these reasons, the DCF model suggests a degree of precision which is in fact not present and leaves wide room for controversy about the level of k [cost of equity].[52]

The "self-correcting nature of the DCF model" is worth further consideration. It is true that an increase in the allowed ROE could increase P_0 in equation (5) by enough to offset attendant increases in D_1 and g, thereby leaving k unchanged. Likewise, a decrease in P_0 could cancel out a lower D_1 and g. This situation is akin to a regulator awarding an atypically high or low ROE to one utility relative to other similar utilities. Here, assuming all else constant, the impact of the change in the ROE is likely to be accounted for in the affected utility's P_0, D_1, and g as the market's overall expected rate of return on utility equity, k, remains unaltered.[53] However, let us consider the other extreme where, for every rate case in the upcoming year throughout the nation, the presiding utility commission arbitrarily awards an ROE of 15% when the average was previously 10%, even though capital markets and other conditions are expected to be unchanged. The utilities afforded a rate increase will see the value of their common stock rise because of increased earnings. Like a bond selling at a discount to par value, the stock price

[51] Morin, *New Regulatory Finance*, 307.

[52] *Id.*, 431.

[53] However, if the prevailing authorized ROEs for utilities are excessive, an atypically low ROE does not mean that the utility receives less than what is required to fund its assets. See the discussion of market-to-book values in Section II.B Expected Earnings.

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of the utilities remaining at the lower 10% rate will decrease because the overall expected return has been pulled towards the higher 15%. If an analyst were to use the DCF methodology to estimate the cost of equity for utilities using the financial data from this market, they would see an increased estimate for the current year relative to the prior year. This result is rather intuitive; as FERC stated, the DCF model is based on the premise that common stock is worth the present value of dividends discounted at the expected rate of return. It follows that if regulators allow higher ROEs, assuming all else constant, this will result in a higher expected rate of return on utility stock and utility earnings will be discounted at an accordingly higher rate in a DCF analysis.

In fairness, although the estimate from the DCF model depends on regulatory outcomes, there is a degree of objectivity which is not present in either the Expected Earnings or Risk Premium methodology as the common stock price at least somewhat reflects investors' required return throughout the capital markets. Namely, the k in the DCF model correlates with prevailing interest rates in the economy. After a low interest rate environment occurred in the aftermath of the 2008/2009 financial crisis, the DCF model indicated a lower cost of equity compared to earlier periods. It was these capital market conditions which prompted the Commission to question the reduced estimate from the DCF model. Per the Briefing Order:

> [T]he 10-year U.S. Treasury bond rates, beginning with the recession of 2008/2009 and continuing through the periods at issue in these proceedings, are the lowest since the early 1960s…
>
> In Opinion No. 551, the Commission relied on the low 10-year U.S. Treasury bond yields during the January to June 2015 period to find that capital market conditions were "anomalous" during that period. The Commission found that, in those circumstances, the Commission had "less confidence" that the midpoint of the zone of reasonableness determined by the DCF analysis satisfied the *Hope* and *Bluefield* capital attraction standards. The Commission then considered the alternative cost of equity models to corroborate the Commission's determination

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> to set MISO TOs' ROE "at a point above the midpoint" of the DCF analysis' zone of reasonableness, i.e., the midpoint of the upper half of the zone.[54]

The Commission further noted the "model risk" posed by the DCF result in the Briefing Order:

> We also note that, in recent years, utility stock prices appear to have performed in a manner inconsistent with the theory underlying the DCF methodology. Under that theory, increases in a company's actual earnings or projected growth in earnings would ordinarily be required to justify an increase in the company's stock price. However, as described in the *Coakley* Briefing Order, although the Dow Jones Utility Average increased by almost 70 percent from October 1, 2012 through December 1, 2017, there was not an increase in either utility earnings or projected earnings during that period that would justify the substantial increase in stock prices. This is an example of what MISO TOs have described as "model risk" —the risk that in some circumstances a model will produce results that do not reflect real world experience. It appears that, for whatever the reason, investors have seen greater value in utility stocks than the DCF methodology would predict. This suggests that the ROE estimated by that methodology may be correspondingly inaccurate.[55]

As various complainants rightfully noted, FERC inexplicably did not account for the k part of the DCF model in the above analysis. Of course, if the market discount rate falls, then the stock price can rise without a change in expected earnings. A cursory overview of the capital markets during this time-period would have revealed that investors sought higher yields in riskier equity over bonds because interest rates were so low. FERC in Opinion 569, however, did not admit to its mistake in the Briefing Order and noted only that:

> [T]he issue of whether the low-interest rate capital market conditions during 2015 were "anomalous" or may have distorted the results of the DCF model are not relevant to our revised approach… we are averaging the results of the DCF and CAPM models to determine a composite zone of reasonableness and setting the ROE… There is thus no need to find that low-interest rate capital market conditions distort the results of a DCF analysis…[56]

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[54] Briefing Order, 165 FERC ¶ 61,118 at P 45.

[55] *Id.* at 47.

[56] Opinion No. 569, 169 FERC ¶ 61,129 at P 170 (2019).

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Although FERC in Opinion 569 ducked the question of whether "anomalous" conditions caused the DCF estimate to become inaccurate, the Commission's framing of the low interest rate environment is yet another way in which the awarded ROE has been biased upwards over the past decade. In both Opinions 531 and 551, FERC found that the "anomalous" capital market environment caused it to have "less confidence" about the result from the midpoint of the DCF analysis. When pressed by the complainants on what specifically led to this doubt, FERC offered the following explanation:

> [A] direct causal analysis linking specific capital market conditions to particular inputs or assumptions in the DCF model is not necessary. Consistent with Opinion No. 531, we find that the DCF methodology is subject to model risk of providing unreliable outputs in the presence of unusual capital market conditions. The Commission has not required a mathematical demonstration of how each anomalous capital market condition specifically distorts the DCF analysis and it is uncertain whether such an analysis is even possible given the complexities of capital markets and how various phenomena could affect the DCF methodology results. For that reason, in the presence of anomalous capital market conditions, the Commission examines other evidence, namely the results of alternative methodologies and state-commission approved ROEs to assess the reasonableness of the results of the DCF methodology. We find that the record contains sufficient evidence of anomalous capital market conditions.[57]

As stated above, FERC could not point to anything concretely problematic with the DCF model in and of itself, that the DCF result appeared "unreliable" to the Commission was essentially a value judgement that relatively low ROE estimates are inherently distorted. In other words, there was no objective reason for choosing to associate the DCF analysis with "model risk" and not the other methodologies. Given the historically low costs of capital under consideration, a more reasonable interpretation of the evidence would have been that the models *besides* the DCF analysis were distorted because they did *not* appropriately account for changes in interest rates. In Opinion 569, after more than a decade of low yields, it would have been

[57] Opinion No. 551, 156 FERC ¶ 61,234 at P 125 (2016).

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untenable for FERC to claim that "anomalous" conditions affected the DCF result, so the Commission dropped this pretext and claimed that it was necessary to consider other models. To be sure, had FERC correctly diagnosed the prevailing market conditions in Opinions 531 and 551, it would have lost its justification to place the awarded ROE above the DCF midpoint and to "corroborate" that placement using other methods which were even more flawed than the DCF model.

In summary, the main problem with the DCF analysis is its innate circularity. The model has nonetheless retained a prominent role in ROE proceedings and its adjudication mainly involves issues of implementation. In fact, even the MISO CAPs argued that the DCF analysis should primarily determine the awarded ROE.[58] Nonetheless, although use of the DCF model to estimate the fair ROE is commonly taken as an article of faith, the self-fulfilling nature of the methodology is apparent when considering the fundamental role of the regulator in determining the model's inputs. Although the DCF model is circular, as FERC obliquely acknowledged when recalling its statement that "all of the models contain some circularity", there is an element of objectivity in the method which is not present in the Expected Earnings or Risk Premium analysis as the opportunity costs of alternative investments are impounded in the common stock price. Unfortunately, this modicum of truth, which suggested a relatively low cost of equity for the period under consideration because of low interest rates, was buried by FERC when it suggested in Opinions 531 and 551 that, despite several years of evidence to the contrary, capital market conditions were "anomalous". This assertion led to the diminishment of the model's traditional role in determining the ROE, thereby unfairly negating the effect that historically low interest rates should have had on the final ruling.

[58] Initial Paper Hearing Brief of the MISO Complaint-Aligned Partied in Docket No. EL14-12-003 at 12-13.

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E. Capital Asset Pricing Model

The remaining model to discuss in FERC's Opinion 569 is the CAPM. FERC provided the following description:

> Investors use CAPM analysis as a measure of the cost of equity relative to risk. The CAPM methodology is based on the theory that the market-required rate of return for a security is equal to the risk-free rate, plus a risk premium associated with the specific security. Specifically, the CAPM methodology estimates the cost of equity by taking the "risk-free rate" and adding to it the "market-risk premium" multiplied by "beta." The risk-free rate is represented by a proxy, typically the yield on 30-year U.S. Treasury bonds. Betas, which are published by several commercial sources, measure a specific stock's risk relative to the market. The market risk premium is calculated by subtracting the risk-free rate from the expected return. The expected return can be estimated either using a backward-looking approach, a forward-looking approach, or a survey of academics and investment professionals. A CAPM analysis is backward-looking if the expected return is determined based on historical, realized returns. A CAPM analysis is forward-looking if the expected return is based on a DCF analysis of a large segment of the market. Thus, in a forward-looking CAPM analysis, the market risk premium is calculated by subtracting the risk-free rate from the result produced by the DCF analysis.[59]

The traditional CAPM is represented by the following equation:

$$(6)\ R_i = R_f + B_i * (R_m - R_f)$$

where: R_i = expected return of stock i
R_f = risk-free rate of return
B_i = beta of stock i
R_m = expected market return
$R_m - R_f$ = market risk premium

In Opinion 569, FERC added a "size premium adjustment" to the traditional model to account for the alleged riskiness of small stocks over large stocks. In formula form:

$$(7)\ R_i = R_f + B_i * (R_m - R_f) + SPA$$

[59] Opinion No. 569, 169 FERC ¶ 61,129 at P 229 (2019).

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In comparison to the prior models, the CAPM is relatively free from regulator influence. The risk-free rate and market risk premium are parameters determined independently of the equity investment under consideration. The beta is the correlation between the utility stock return and the market return.[60] The regulator can be seen to influence beta through the utility stock return but its effect is ambiguous because of the presence of the market return. In other words, the pathologies stemming from the circularity of outcomes which pervade the previously described methodologies do not afflict the CAPM. Dr. Morin also reflected favorably on this aspect of the CAPM, stating, "On the positive side, as a tool in the regulatory arena, the CAPM is a rigorous conceptual framework, and is logical insofar as it is not subject to circularity problems, since it inputs are objective, market-based quantities, largely immune to regulatory decisions."[61] Given the advantages of the CAPM, it is reasonable for regulators to adopt this methodology in determining the fair ROE. However, FERC's approach in Opinion 569 involved the misspecification of all the traditional CAPM parameters as well as the untoward inclusion of the size premium adjustment. Each of these issues is discussed in detail in the below subsections.

1. Risk-Free Rate and the Market Risk Premium

It is useful to consider the risk-free rate and the market risk premium together as these parameters similarly do not rely on utility-specific data, moreover the market risk premium is the expected market return minus the risk-free rate. A typical approach for the risk-free rate is to use the yield on U.S. Treasury debt. FERC adopted the following methodology in Opinion 569:

> We find that the evidence supporting the use of the 30-year U.S. Treasury average historical bond yield over a six-month period as the risk-free rate outweighs the evidence supporting the use of the 20-year U.S. Treasury yield. RPGI is the only

[60] Specifically, beta is the covariance between the equity return and market return divided by the variance of the market return.

[61] Morin, *New Regulatory Finance*, 443.

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> party to propose using the 20-year U.S. Treasury yield and the other evidence and precedent provides greater support for using the 30-year U.S. Treasury yield. Accordingly, we adopt use of the 30-year U.S. Treasury average historical bond yield over a six-month period as the risk-free rate.[62]

Thus, based on the average yield on 30-year U.S. Treasury bonds from January-June 2015, FERC used a risk-free rate of 2.69% in the CAPM.[63] It is unfortunate that the Commission's approach was given little challenge as the selection of the yield on 30-year U.S. Treasury bonds, which is the longest-term maturity offered, meant that the highest rate on the U.S. Treasury yield curve, which most always slopes upward as the term to maturity increases, was used as the risk-free rate. For example, the yield on 10-year and 20-year U.S. Treasury debt over the same period was 2.07% and 2.47%, respectively.[64]

As for the evidence which supported using the yield on 30-year U.S. Treasury bonds, FERC cited Dr. Morin:

> At the conceptual level, because common stock is a long-term investment and because the cash flows to investors in the form of dividends last indefinitely, the yield on very long-term government bonds, namely, the yield on 30-year Treasury bonds, is the best measure of the risk-free rate for use in the CAPM and Risk Premium methods. The expected common stock return is based on long-term cash flows, regardless of an individual's holding time period. Utility asset investments generally have long-term useful lives and should be correspondingly matched with long-term maturity financing instruments.[65]

There are reasons to doubt this analysis. Unlike short-term Treasury yields, the yields from long-term Treasury bonds include a premium to compensate for interest rate risk, so they are not "risk-free" in the truest sense. As explained in *Principles of Corporate Finance* by Brealey,

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[62] Opinion No. 569, 169 FERC ¶ 61,129 at P 88 (2019).

[63] Trial Staff Initial Br. (I), Attachment A to App. 2 at 6.

[64] See "10-Year Constant Maturity Rate", FRED Economic Data, https://fred.stlouisfed.org/series/DGS10 and "20-Year Constant Maturity Rate", FRED Economic Data, https://fred.stlouisfed.org/series/DGS20.

[65] Opinion No. 569, 169 FERC ¶ 61,129 at P 237 (2019) citing Morin, *New Regulatory Finance*, 151-152.

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Myers, and Allen, given uncertainty about Treasury bill rates in future periods, investors oftentimes use a Treasury bond yield as the risk-free rate.[66] However, this does not imply that investors are inclined to view the yield from the longest-term Treasury security as the risk-free rate. Deeming the yield on the 30-year Treasury bond as "the best measure of the risk-free rate" is essentially just a way to tack on a few basis points to the ROE by incorporating the highest possible proxy for the risk-free interest rate in the CAPM.

FERC gave the following description on its approach to the market risk premium:

> We continue to find reasonable the MISO TOs' proposal to estimate the CAPM expected market return using a forward-looking approach, based on applying the DCF model to the dividend paying members of the S&P 500. Using a DCF analysis of the dividend-paying members of the S&P 500 is a well-recognized method of estimating the expected market return for purposes of the CAPM model. The DCF analysis must be limited to the dividend-paying members of the S&P 500, rather than using all companies in the S&P 500, because a DCF analysis can only be performed on companies that pay dividends.[67]

At issue was whether the application of the DCF methodology on the S&P 500 companies would involve a "two-step" approach where the growth rate, g, would blend both short-term and long-run projections of future earnings as was done when FERC used the DCF model to estimate the cost of equity for the sample utilities, or a "one-step" approach where only short-term projections are used. FERC offered the following explanation for its decision to adopt the one-step procedure for the CAPM:

> In summary, while it may be unreasonable to expect an individual company to sustain high short-term growth rates in perpetuity, the same cannot be said for a broad representative market index that is regularly updated to include new companies. Put differently, a portfolio of companies behaves differently than an individual company. Accordingly, the rationale for incorporating a long-term growth rate estimate in conducting a two-step DCF analysis of a specific utility or

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[66] Richard Brealey, Stewart Myers, Franklin Allen, *Principles of Corporate Finance,* 13th ed. (New York, NY: McGraw-Hill Education, 2020), 235.

[67] Opinion No. 569, 169 FERC ¶ 61,129 at P 260 (2019).

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> group of utilities for purposes of directly estimating cost of equity does not apply to the DCF analysis of a broad representative market index with a wide variety of companies that is regularly updated to include new companies for purposes of determining the required return to the overall market.[68]

It's hard to see how the foregoing could explain away the incoherency between applying the two-step DCF when estimating the expected return for the sample utility companies and the one-step DCF when estimating the expected return from the dividend-paying S&P 500 companies for use in the CAPM. The Commission in fact cited the following passage from Dr. Morin in support of the two-step approach for its DCF analysis of the sample utilities:

> The problem is that from the standpoint of the DCF model that extends into perpetuity, analysts' horizons are too short, typically five years. It is often unrealistic for such growth to continue into perpetuity. A transition must occur between the first stage of growth forecast by analysts for the first five years and the company's long-term sustainable growth rate... It is useful to remember that eventually all company growth rates, especially utility service growth rates, converge to a level consistent with the growth rate of the aggregate economy.[69]

It was wholly inconsistent for FERC to initially observe that the growth rates of "all" companies converge to that of the overall economy and subsequently ditch this assertion when calculating the expected return for the dividend-paying companies in the S&P 500. Furthermore, a tenet of the CAPM is that the expected market rate of return is a proxy for the entire investment market. Even if one were to concede the Commission's dubious argument that the S&P 500 can indefinitely sustain higher growth rates than that of the overall economy, the point would be moot because the market risk premium used in the CAPM is a proxy for the entire investment market and it was already found that the growth rate of the investment market is constrained by underlying economic growth. FERC's contradictory approach in its use of the one-step DCF

[68] *Id.* at P 266.

[69] Opinion No. 569, 169 FERC ¶ 61,129 at P 152 (2019) citing Morin, *New Regulatory Finance*, 308.

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analysis led to an estimated market return of 11.81%, subtracting the risk-free rate of 2.69% resulted in a 9.12% market risk premium used in the CAPM. The two-step procedure gave an estimated market return of 10.30% which, after subtracting the risk-free rate, indicated a 7.61% market risk premium.[70]

Beyond the debate on the growth rate of dividends, a more fundamental problem is the misalignment between FERC's accepted market risk premium and the market risk premium used by investors. Although the MISO CAPs identified authorities which reported a much lower expected market risk premium than that applied by FERC, the Commission dismissed these observations:

> [The MISO CAPs] cite a PIMCO report calculating a forward-looking equity risk premium of 3.9 percent calculated by comparing the projected 10-year return of the S&P 500 to inflation protected 10-year treasury bonds. They also state that the American Appraisal Risk Premium Quarterly calculated a forward-looking risk premium of 6.0 percent, Duff & Phelps calculated a forward-looking risk premium of 5.0 percent, and *Value Line* estimated that the required equity premium above the yield on ten-year bonds in order to induce investment in corporate equity was about 5.5 percent.
>
> There are a variety of views as to the reasonable market risk premium to include in a CAPM study and what method to use to determine that premium, as is clear from Dr. Morin's summary of academic studies of both historical and prospective market risk premiums. Dr. Morin concludes that "Faced with this myriad, and often conflicting, evidence on the magnitude of the risk premium, a regulator might very well be confused about the correct market risk premium." Although the risk premiums we approve in this order exceed those of certain other analyses, we find that their determination is analytically sound and supported by the evidence in this proceeding.[71]

The issue with this reasoning was that it was not just "certain other analyses" which caused FERC's market risk premium of 9.12% to appear unduly high. In addition to the credible

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[70] Trial Staff Initial Br. (I), Attachment A to App. 2, two-step at 4 and one-step at 6.

[71] Opinion No. 569, 169 FERC ¶ 61,129 at P 272-273 (2019).

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data provided by the MISO CAPs, the preponderance of evidence at this time suggested that FERC's estimate was an extreme outlier. Graham and Harvey (2015) examined survey data of 414 U.S. CFOs and, where the equity risk premium was defined as the expected 10-year S&P 500 return relative to a 10-year U.S. Treasury bond yield, found that the 10-year equity risk premium was 4.51%.[72] Fernandez, Ortiz Pizarro, and Fernandez Acin (2015) conducted a survey on the risk-free rate and market risk premium used by academics and financial professionals for various international markets. Based on 1,983 survey responses for the U.S., the average market risk premium was 5.5% while the average risk-free rate was 2.4%.[73] [74]

Such results beg the question: what caused FERC's estimate to be significantly higher than that indicated by the broad investment community? After all, discarding the absurdly high 9.12% market risk premium from the one-step DCF analysis still leaves a discrepancy between the 7.61% market risk premium from the two-step DCF analysis and the range of 4-6% used by most market participants in 2015. The likely answer is that taking the expected returns from only dividend-paying companies biased the estimate upwards. Stocks with high growth potential which don't pay a dividend oftentimes have a high price-to-earnings ratio which is analogous to the inverse of the dividend-yield in the DCF model. The effect of incorporating these non-dividend paying firms which trade at a high price relative to earnings could be to reduce the

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[72] John R. Graham and Campbell R Harvey, "The Equity Risk Premium in 2015" (October 1, 2015). Available at SSRN: https://ssrn.com/abstract=2611793 at 7 (Table 1).

[73] Pablo Fernandez, Alberto Ortiz Pizzaro, and Isabel Fernandez Acin, "Discount Rate (Risk-Free Rate and Market Risk Premium) Used for 41 Countries in 2015: A Survey" (October 17, 2017). Available at SSRN: https://ssrn.com/abstract=2598104 at 3 (Table 2 – Market Risk Premium) and 4 (Table 3 – Risk Free Rate).

[74] The authors provided the following description of their survey methodology at 2.: "We sent a short email (see exhibit 1) on the period March 15 - April 10, 2015 to about 22,500 email addresses of finance and economic professors, analysts and managers of companies obtained from previous correspondence, papers and webs of companies and universities. We asked about the Risk Free Rate and the Market Risk Premium (MRP) used 'to calculate the required return to equity in different countries'."

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overall expected return from the sample of dividend payers. For example, Damodaran (2021) determined the equity risk premium by using the expected free cash flow to equity instead of expected dividends in a DCF-style analysis. This allowed for inclusion of the entire S&P 500 in the estimate, resulting in a 5.78% equity risk premium at the start of 2015.[75] Whether sample bias, differences in methodology, or a combination thereof caused the discrepancy between FERC's estimate of the market risk premium and that used by the typical market participant, the important point is that the objective evidence supports that the Commission adopted an excessively high parameter.

If FERC were to appropriately reconsider its approach to the market risk premium based on the investment community's assessment, utility witnesses would likely impugn the reliance on surveys or other public data. For instance, Dr. Morin offered a criticism on the use of surveys to determine the market risk premium:

> There are several reasons to place little weight on survey results relative to the results from other approaches. First, return definitions and risk premium definitions differ widely. Second, survey responses are subject to bias. Surveys may tell more about hoped-for expected returns rather than objective required returns. Third, subjective assessments about long-term market behavior may well place undue weight on recent events and immediate prospects.[76]

It would be improper for regulators to dismiss evidence on the market risk premium from survey data or other financial authorities based on these assertions. For one, in the DCF model, FERC explicitly incorporated the financial industry's consensus on utilities' expected earnings growth by relying on IBES estimates. As the Commission explained in Opinion 569:

> IBES compiles the growth projections of a number of analysts at different

[75] Aswath Damodaran, "Equity Risk Premiums (ERP): Determinants, Estimation, and Implications – The 2021 Edition" (March 23, 2021). Available at SSRN: https://ssrn.com/abstract=3825823, at 91-92.

[76] Morin, *New Regulatory Finance*, 161-162.

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> brokerage and investment firms. The IBES growth projections thus generally represent an average of projections made independently of one another by a number of analysts at different institutions. Data sources can reflect investor expectations by being used by large numbers of investors and/or being themselves the results of the analysis of a diverse group of persons in the investment community. Both IBES and *Value Line* growth rates are used by large numbers of investors but only IBES growth rates reflect the analysis of a diverse group of persons in the investment community.[77] [78]

In essence, survey data on market participants' expectations for the market risk premium provides the same function as the use of IBES earnings growth forecasts in the DCF model. In each case, a key financial parameter is averaged across a wide swath of investors to determine a consensus estimate which is employed in the determination of the cost of equity. FERC also cited the following from Dr. Morin in support of the IBES growth rates:

> Exclusive reliance on a single analyst's growth forecast runs the risk of being unrepresentative of investors' consensus forecast. One would expect that averages of analysts' growth forecasts, such as those contained in IBES or Zacks, are more reliable estimates of investors' consensus expectations likely to be impounded in stock prices. Averages of analysts' growth forecasts rather than a single analyst's forecasts are more reliable estimates of investors' consensus expectations.[79]

In contrast, the Commission ignored the consensus in its implementation of the CAPM by calculating its own estimate of the forecasted market return, essentially a single analyst's estimate, without checking if this at all aligned with the expectations of actual investors. By FERC's logic in Opinion 569, grounding financial models on the consensus expectations of market participants is important when using the DCF model to determine the utility cost of equity but can be disregarded when developing the market risk premium in the context of the CAPM. This double standard reveals the capriciousness of the Commission's approach.

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[77] Opinion No. 569, 169 FERC ¶ 61,129 at P 125 (2019).

[78] In the Second Complaint proceeding, the MISO TOs proposed the use of Value Line estimates of expected earnings growth in place of IBES growth estimates, but this was rejected by FERC in Opinion 569 as the estimate only reflected the forecast of a single institution.

[79] Opinion No. 569, 169 FERC ¶ 61,129 at P 126 (2019) citing Morin, *New Regulatory Finance* at 302.

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Nonetheless, even though objective evidence on the average investor's market risk premium makes FERC's estimate transparently excessive, utility advocates may argue in the same manner as Dr. Morin that because surveys contain risk premium definitions which "differ widely" and/or "are subject to bias", they cannot inform the CAPM. Such assertions should not be viewed credibly if made. For one, FERC's approach is "subject to bias" in an apparent way from having left out a significant portion of the S&P 500 in the non-dividend paying companies. Furthermore, even if there are slight differences in the definition of the market risk premium used by the aforementioned references, this cannot possibly explain the chasm between the survey results of 4-6% and the 9.12% used by the Commission. If, as according to Dr. Morin, "surveys tell more about hoped-for expected returns" then it must be that FERC was positively jubilant in its assessment of future market performance. The Commission's hand-waving dismissal of this discrepancy only served to ensure that investor expectations did not factor into the CAPM while contradictorily alleging the importance of incorporating investor expectations elsewhere in determining the cost of equity.

It is worth further reflecting on the difference between investors' expected market return and the ROE ultimately awarded by FERC. Taking the results from Fernandez, Ortiz Pizarro, and Fernandez Acin (2015) as representative of market expectations, adding the risk-free rate of 2.4% to the 5.5% market risk premium results in an expected market return of 7.9%, while FERC's awarded ROE for the MISO TOs in Opinion 569-A was 10.02%.[80] As dictated by

[80] In FERC's midpoint methodology, the average of the highest and lowest estimates from the zone of reasonableness determined the result for the CAPM. Using the CAPM data provided by the Trial Staff (see Exhibit III of the Appendix), under a Risk Premium of 9.12%, the highest estimate was 13.09% from Black Hills Corp. while the lowest estimate was 7.8% from Duke Energy Corp. (or equivalently Southern Co.). Using the Fernandez (2015) market risk premium of 5.5% results in an average estimate of 7.64% while the average is 10.45% under FERC's approach. As such, the effect of using FERC's unrealistically high Risk Premium was to raise the CAPM estimate by ~280 basis points.

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common sense given the inherent safety of utility investments afforded by a government-granted monopoly franchise, an assertion supported by historical utility betas of well less than 1.0 as shown in the following subsection, investors' expected market return should effectively set a ceiling on the ROE approved by regulators as utility stock is less risky than the overall stock market. It follows that it was simply unreasonable for the Commission to find that the cost of equity for the MISO TOs was more than 200 basis points higher than the rate of return required for an average stock. To reiterate, defenders of FERC's methodology would likely attempt to impugn the reliability of the 7.9% expected market return suggested by the survey data, but there would be no reason to reject the preponderance of evidence which suggested that the 7.9% rate was a reasonable estimate in favor of the Commission's biased approach.

2. Utility Betas

In addition to the risk-free rate and market risk premium, the other key parameter in the implementation of the traditional CAPM is beta, the B_i term in equation (6). FERC provided the following description of beta in its Briefing Order:

> The CAPM provides a market-based approach determined by beta, a measure of the risk based upon the volatility of a company's stock price over time in comparison to the overall market, and the risk premium between the risk-free rate (generally, long-term U.S. Treasury bonds) and the market's return (generally, the return of the S&P 500 or another broad indicator for common stocks).[81]

In financial economics, volatility is synonymous with risk. Hence, companies with betas of less than 1.0 are seen as less risky than the overall market, betas above 1.0 are more risky, and betas ~1.0 mimic the riskiness of the market. In Opinion 569, FERC relied on Value Line's estimate of

[81] Briefing Order, 165 FERC ¶ 61,118 at P 36.

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beta for the sample utility companies. The MISO CAPs provided the following description of Value Line's methodology:[82]

> *Value Line* measures a "raw" beta based on a regression of the monthly returns of the individual companies, relative to the New York Stock Exchange, over a five-year period. *Value Line* then adjusts the raw beta for the long-term tendency of beta to converge on the market beta of 1 over long periods of time. *Value Line's* adjusted betas represent a raw beta estimate given two-thirds weight and the market beta of 1 given one-third weight. *Value Line* publishes its adjusted betas.[83]

The justification for adjusted betas relies on the observation that "raw" betas, or the betas observed from the statistical relationship revealed by regressing utility stock returns on overall market returns, tend towards the average beta (a.k.a. market beta) of 1.0 over time. Utility companies, true to their reputation as safe investment assets, generally have betas of less than 1.0. As shown in Exhibit II of the Appendix, all of the sample utility companies had, as reported by Value Line, adjusted betas of less than 1.0 with an average adjusted beta of 0.75, meaning that the average unadjusted beta, which measures the actual statistical relationship between the utility and market return series, was 0.625.[84] As such, the application of adjusted betas in the CAPM had the effect of increasing the estimated cost of equity as the raw betas were adjusted upwards. Using adjusted betas instead of the appropriate unadjusted betas increased the CAPM

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[82] Value Line provides the following description of its methodology: "At Value Line, we derive the Beta coefficient from a regression analysis of the relationship between weekly percentage changes in the price of a stock and weekly percentage changes in the NYSE Composite Index over a period of five years. In the case of shorter price histories, a shorter time period is used, but two years is the minimum. Value Line then adjusts these Betas to account for their long-term tendency to converge toward 1.00.". Andrew J. Cueter, "Using Beta", Value Line, October 2, 2012, https://www.valueline.com/Tools/Educational_Articles/Stocks/Using_Beta/

[83] MISO Complaint-Aligned Parties Initial Brief at 32 in Docket No. EL14-12-003.

[84] From Exhibit II of the Appendix, the average Value Line beta for the utility proxy group was 0.75. Undoing the Value Line adjustment results in a beta of 0.625 ((0.75 – 1/3)*3/2 = 0.625).

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estimate by ~100 basis points.[85] Unfortunately, no party challenged the use of Value Lines's adjusted betas in the dockets pertaining to Opinion 569.

The rationale for adjusted betas stretches back to Blume (1971) where the long-run convergence of beta towards 1.0 was observed and an adjustment to beta was suggested which was the progenitor of the Value Line adjustment. However, Blume's findings were based on all stocks in the New York Stock Exchange, not individual securities. Although the convergence of betas towards 1.0 is perhaps a fair assumption to make *on average* across the entire stock market, it is not necessarily true that this characterizes the beta of a specific security. Of course, in ROE proceedings, the issue is the riskiness of a particular kind of security: utility stock. When determining the fair ROE for a utility using the CAPM, the concern is (or should be) with how *utility* betas vary over time. If utility betas do not have a long-run average of 1.0, then the use of adjusted betas in utility ROE proceedings is unjustified.

Some studies have supported that the long-run average of utility betas is significantly lower than 1.0. Gombola and Kahl (1990) concluded that the assumption of an underlying mean beta of 1.0 was too high for most utilities and indicated that the historical mean was closer to 0.5. Michelfelder and Theodossiou (2013) showed empirically that utility betas do not have a tendency to converge to 1.0 and concluded that the adjusted betas as reported by Value Line are not applicable for public utilities. Although these studies relied on several regression analyses to support their findings, all that is really needed to debunk the applicability of the Value Line adjustment to utility betas is a plot of the historical unadjusted beta vs. adjusted beta. The below

[85] In FERC's midpoint methodology, the average of the highest and lowest estimates from the zone of reasonableness determined the result for the CAPM. Using the CAPM data provided by the Trial Staff (see Exhibit III of the Appendix), the highest estimate was 13.09% from Black Hills Corp. with a 0.95 Value-Line beta, the lowest estimate was 7.8% from Duke Energy Corp. (or equivalently Southern Co.) with a 0.6 Value-Line beta. Unadjusting the betas results in an average estimate of 9.42% while the average is 10.45% with adjusted betas. As such, using Value-Line adjusted betas raised the CAPM result by ~100 basis points.

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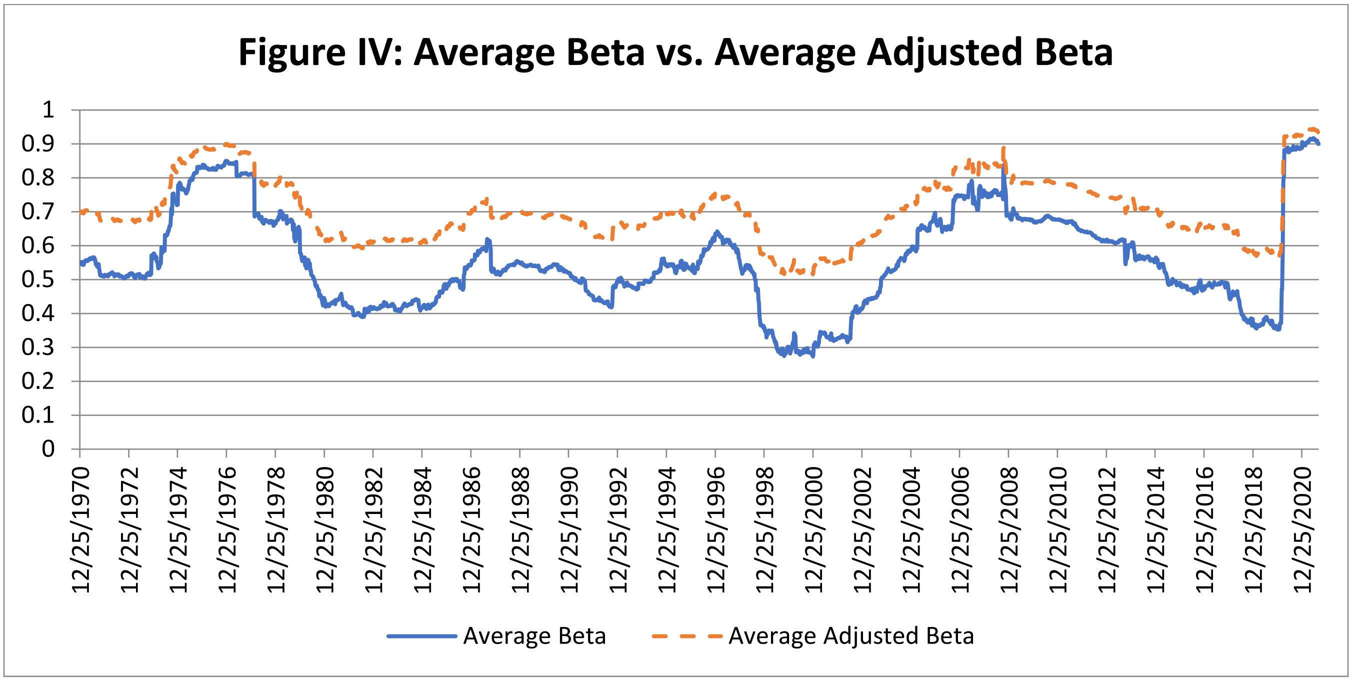
Figure IV provides a graph of these historical series based on data from Yahoo Finance for the sample utility companies available as of December 2021. The Average Beta represents the mean unadjusted or "raw" utility beta and the Average Adjusted Beta indicates the mean utility beta after applying the Value Line adjustment.[86]



It is undeniable based on Figure IV that the Value Line adjustment is inappropriate. Clearly, utility betas have been consistently below 1.0 and, as shown in Exhibit II of the Appendix, the historical sample suggests an average of 0.55. Although the average adjusted beta for 2015 based on the Yahoo Finance data came to 0.69 while the average Value Line beta was 0.75, this sort of discrepancy resulting from the use of different financial sources cannot justify the use of adjusted betas as the average historical beta is significantly below 1.0 no matter the source of information. Even when considering the Value Line betas of the proxy utility group, not a single estimate was at or above 1.0, an observation which should have caused one of the

[86] See Exhibit II of the Appendix for further detail on the data used for Figure IV.

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parties to question the legitimacy of an adjustment whose premise is that betas "converge" to 1.0. In any case, a brief review of the historical data puts the question beyond doubt.

It would be remiss to not mention the abrupt and unprecedented increase in utility betas which occurred in spring 2020, although this information was not a factor in Opinion 569 as FERC's decision only considered data from 2015. Exhibit IV of the Appendix details how this increase should be viewed as a vagary resulting from the financial turbulence during the onset of the COVID-19 pandemic. An equally precipitous decline should occur in spring 2025 once the COVID-19 observations roll out of the beta calculation, meaning that utility betas of ~0.9 should not be considered as representative of the systematic risk of utility stock in forthcoming periods.

3. Size Premium and Other Adjustments

In Opinion 569, the Commission found that the application of a size premium adjustment to the CAPM was warranted, stating, "we conclude that the size premium adjustments improve the accuracy of the CAPM results and cause it to better correspond to the costs of capital estimates employed by investors."[87] FERC cited the following passage from Dr. Morin in support:

> Investment risk increases as company size diminishes, all else remaining constant. Small companies have very different returns than large ones, and on average they have been higher. The greater risk of small stocks does not fully account for their higher returns over many historical periods.[88]

In other words, the rationale for the size premium adjustment is that for firms with smaller market capitalization vis-à-vis larger firms, the traditional CAPM underpredicts the actual stock return, even after considering the higher betas of small firms, so an upwards adjustment is made.

[87] Opinion No. 569, 169 FERC ¶ 61,129 at P 297 (2019).

[88] *Id.* at P. 299 citing Morin, *New Regulatory Finance*, 181.

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For large firms, the CAPM overpredicts the actual stock return so the size term involves a downwards adjustment. In ROE proceedings, the size premium will typically raise the estimate from the CAPM as public utilities, for the most part, conveniently fall into the small market capitalization category; 32 of the 40 sample utilities used in Opinion 569 had small market capitalizations.[89] As such, the application of the size premium adjustment raised the CAPM estimate by 69 basis points.[90]

The complainant parties as well as FERC's trial staff opposed the use of the size premium adjustment in the CAPM. David C. Parcell, on behalf of the Resale Power Group of Iowa, explained the issue:

> [T]he small size adjustment in the Morningstar studies is based on the analysis of the stock of all publicly-traded companies, the majority of which are unregulated and operate in industries that are much riskier than the utility industry. While it may or may not be true that on an overall market basis, smaller publicly-traded firms exhibit more risk than larger firms, it is true that these smaller companies tend to be engaged in riskier businesses as a whole than do large businesses. But that is definitely not the not the case for regulated electric utilities like the MISO TOs.[91]

As it was for Value Line's adjusted betas, the application of size premiums unfairly assumes that a statistical phenomenon observed over the breadth of the entire stock market also applies to regulated utilities. FERC noted, "though not uniform, a sufficient amount of academic literature exists to indicate that many investors rely on the size premia" and proceeded to cite Dr. Morin

[89] Exhibit II of the Appendix indicates the size premium adjustment for the proxy utilities.

[90] In FERC's midpoint methodology, the average of the highest and lowest estimates from the zone of reasonableness determined the result for the CAPM. Using the CAPM data provided by the Trial Staff (see Exhibit III of the Appnedix), the highest estimate was 13.09% from Black Hills Corp. with a 1.74% size premium adjustment, the lowest estimate was 7.8% from Duke Energy Corp. (or equivalently Southern Co.) with a -0.36% size premium adjustment. Without the size premium adjustment, the average is 9.76% while with the adjustment the average is 10.45%, so the effect of the size premium adjustment was to raise the CAPM estimate by 69 basis points.

[91]Affidavit of David C. Parcell on Behalf of the Resale Power Group of Iowa at P. 14 in Docket No. EL14-12-003.

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amongst other sources which support that a size adjustment is commonly applied when estimating the cost of equity with the CAPM.[92]

Whatever the merit of using a size premium adjustment alongside the traditional CAPM in a general context, the issue at-hand in ROE proceedings should be the economic rationale for applying the adjustment to a group of regulated utilities. Academic writings on this topic are sparse, although the complainants referenced a study by Wong (1993) which failed to find evidence of a size effect for a sample of 152 electric and gas companies from 1968-1987. FERC countered the Wong study by citing Zepp (2003) who suggested a small firm size effect in the utility sector based on a DCF analysis of four water utilities, two large and two small, from 1987-1997. The DCF study revealed a higher cost of equity for the small firms. It's rather ironic that the Commission referenced this study given that it expressly rejected the same type of analysis from its trial staff which, using the financial data from the dividend-paying S&P 500 companies, "shows there is no meaningful relationship between forward-looking DCF results and current market capitalizations."[93] FERC nonetheless found the DCF analysis to be "unconvincing" in this case, stating, "a regression analyses [sic] on the reasonableness of CAPM model inputs using the DCF model is unpersuasive, since that model does not consider betas at all."[94] Apparently, per the Commission, using a DCF analysis to examine the significance of the size effect is only acceptable when in support of its inclusion.

[92] For example, see Roger A. Grabowski, "The Size Effect Continues to be Relevant When Estimating the Cost of Capital", *Business Valuation Review*, Fall 2018, at 93–109 & Roger G. Ibbotson and James P. Harrington, "Using a Non-Beta-Adjusted Size Premium in the Context of the CAPM Will Likely Overstate Risk and Understate Value", Quick Read, Jan. 30, 2019, https://quickreadbuzz.com/2019/01/30/business-valuationgrabowski-harringtonsing-a-nonbeta-adjusted-size-premium.

[93] Initial Brief of the Commission Trial Staff at 16 in Docket No. 14-12-003.

[94] Opinion No. 569, 169 FERC ¶ 61,129 at P 302 (2019).

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Furthermore, the application of the size premium adjustment is motivated by empirical findings which suggest that it improves the CAPM's predictive accuracy. However, its rationale essentially does not extend beyond empirical considerations into stating anything fundamental about the risk of the company to which it is applied, whether large or small. Various authorities have supported that the adjustment is empirical in nature. For example, Brealey, Myers, and Allen in *Principles of Corporate Finance* noted that although the firm size effect can be seen when looking at historical returns, this could have been the result of a chance strategy which worked in the past, otherwise known as "data mining".[95] Damodaran (2021) acknowledged the presence of a size effect when examining historical returns but provided the following criticism:

> Even if you believe that small cap companies are more exposed to market risk than large cap ones, this is a sloppy and lazy way of dealing with that risk, since risk ultimately has to come from something fundamental (and size is not a fundamental factor). Thus, if you believe that small cap stocks are more prone to failure or distress, it behooves you to measure that risk directly and incorporate it into the cost of equity.[96]

Although Damodaran's assessment pertained to the general use of the size premium, it makes apparent the crucial problem with its application to public utilities. Ultimately, FERC did not provide specific evidence as to why the 32 utility companies with small market capitalizations entailed higher risk than that already captured by beta. In all plausibility, the Commission possessed no such evidence; the basis of its rationale rested on a *general* finding on the performance of small vs. large companies across the entire stock market when examining *past* returns. This is not to say that there could never be idiosyncratic factors which merit the

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[95] Richard Brealey, Stewart Myers, and Franklin Allen, *Principles of Corporate Finance* (New York, NY: McGraw-Hill, 2020), 212.

[96] Aswath Damodaran, "Equity Risk Premiums (ERP): Determinants, Estimation, and Implications – The 2021 Edition" (March 23, 2021). Available at SSRN: https://ssrn.com/abstract=3825823, at 52.

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adjustment of the cost of equity obtained from the proxy group of utilities, although no such adjustment was required for the MISO TOs as the Commission found them to be "of average risk".[97] However, it should be incumbent upon regulators to identify those specific business risks and explicitly account for them by directly reducing or increasing the ROE found from the proxy group estimation. The application of the size premium in the context of public utilities should not be viewed credibly as it makes a naïve assumption about the increased risk of "small" utilities.

Despite lacking an economic justification for the size effect, the Commission argued that its inclusion improves the accuracy of the CAPM. This, however, can be viewed as just another finding grounded in self-fulfilling logic. Naturally, any adjustment to the CAPM which increases the estimate for a utility is likely to improve the *historical* performance of the model as it has been the tendency for regulators to award excessive returns. When comparing FERC's CAPM methodology to the approaches recommended herein, FERC's estimate would compare favorably to the historical data as utilities' past returns reflect the rates approved by regulators. To the extent that utility commissions had historically adopted more just and reasonable ROEs based on the actual risks faced by public utilities, then estimates which suggest lower ROEs would appear closer to actual returns.

To put it concretely, according to Exhibit II of the Appendix, the average yearly return for the sample utilities was 11.35%. Whether it was FERC's market risk premium methodology which resulted in an inordinately high estimate of 9.12% for 2015, or the use of adjusted betas which always unduly increase the observed systematic risk of utilities, or the tacking on of a size premium, each of these procedures would return an estimate which more closely resembles the 11.35% than a standard CAPM methodology with a more reasonable estimate of the equity risk

[97] Opinion No. 569, 169 FERC ¶ 61,129 at P 411 (2019).

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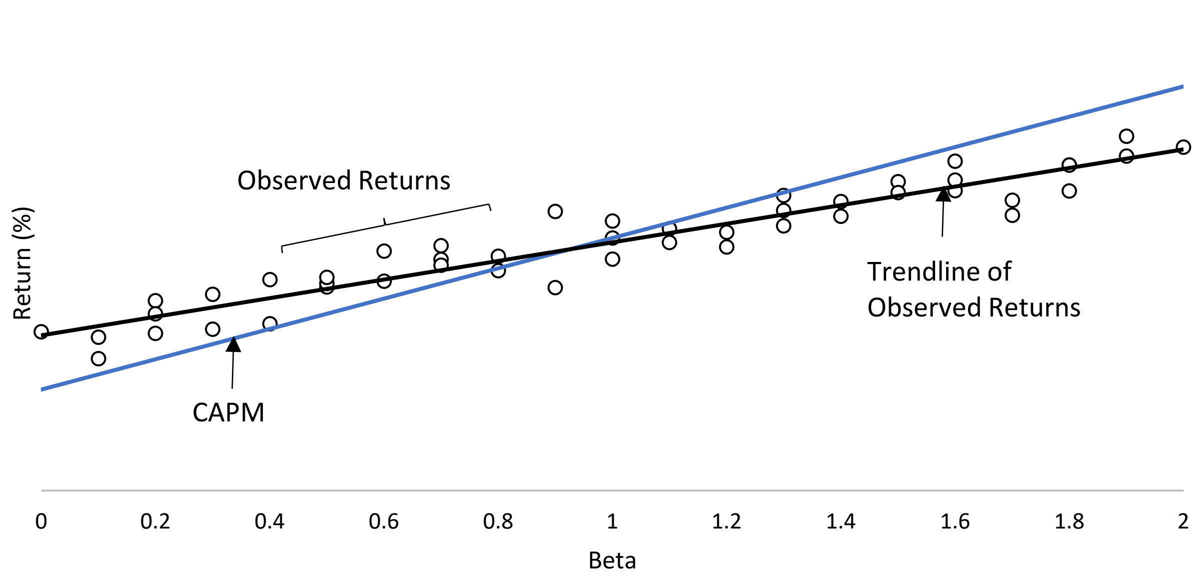
premium, unadjusted betas, and no size premium which produces a lower result. In summary, the observation that FERC's approach to the CAPM improves its historical accuracy is completely irrelevant given regulators' fundamental influence on the observed level of historical returns.

It's worth mentioning that the size premium is but one of numerous adjustments suggested in the financial literature to correct for the empirical shortcomings of the traditional CAPM, although FERC did not adjudicate other such modifications in Opinion 569. The motivation for these adjustments is to flatten the slope of predicted returns from the traditional CAPM in order to more closely approximate the trend of observed returns. Figure V illustrates the issue using example data.

Figure V: CAPM vs. Observed Returns



One such adjustment is the Empirical CAPM or ECAPM. Dr. Avera, in his testimony on behalf of the MISO TOs, referenced the ECAPM recommended by Dr. Morin to determine the cost of equity:

> As discussed in *New Regulatory Finance*, empirical evidence suggests that the expected return on a security is related to its risk by the ECAPM, which is represented by the following formula:

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$$Rj = Rf + 0.25(Rm - Rf) + 0.75[\beta j(Rm - Rf)]$$

> This ECAPM equation, and the associated weighting factors, recognizes the observed relationship between standard CAPM estimates and the cost of capital documented in the financial research, and corrects for the understated returns that would otherwise be produced for low beta stocks.[98]

As it appears above, the ECAPM is mathematically indistinguishable from the application of adjusted beta except that ¼ weight is given to the market beta of 1.0 and ¾ weight is assigned to the raw beta. In keeping with Dr. Morin's recommendation, Dr. Avera even continued to apply Value Line's adjusted betas in the ECAPM, effectively assigning half the weight to the market beta and half to the raw beta.[99] [100] As such, in the context of ROE proceedings, the ECAPM is sometimes used as a veiled measure to further increase the supposed riskiness of utilities and thereby justify a higher cost of equity.

Another oft-cited model is the Fama-French Three-Factor Model which is the traditional CAPM plus a size effect and a term to capture the difference in returns for high-minus-low book-to-market stocks. As noted by Fama and French (2004):

> From a theoretical perspective, the main shortcoming of the three-factor model is its empirical motivation. The small-minus-big (SMB) and high-minus-low (HML) explanatory returns are not motivated by predictions about state variables of concern to investors. Instead they are brute force constructs meant to capture the

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[98] Answering Testimony of William E. Avera, PHD, CFA on Behalf of The MISO Transmission Owners in Docket No. EL14-12-002 at 114.

[99] For Dr. Morin's recommendation that adjusted betas should be used in the context of the ECAPM, see *New Regulatory Finance* at 191. For Dr. Avera's application of the ECAPM, see Answering Testimony of William E. Avera, PHD, CFA on Behalf of The MISO Transmission Owners in Docket No. EL14-12-002 at Exhibit No. MTO-11.

[100] Where $Beta_{Market} = 1.0$:

- $Beta_{Adjusted} = 2/3(Beta_{Raw}) + 1/3(Beta_{Market})$
- ECAPM Betas where B_j is $Beta_{Raw} = 1/4(Beta_{Market}) + 3/4(Beta_{Raw})$
- ECAPM Betas where B_j is $Beta_{Adjusted} = 1/4(Beta_{Market}) + 3/4(2/3(Beta_{Raw}) + 1/3(Beta_{Market}))$
  $= 1/2(Beta_{Market}) + 1/2(Beta_{Raw})$

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> patterns uncovered by previous work on how average stock returns vary with size and the book-to-market equity ratio.[101]

Once more, it can be seen how extensions of the CAPM aren't associated with an underlying economic justification for why, assuming all else equal, small market-cap companies or firms with high book-to-market ratios should be determined to have a higher cost of equity; it just so happens that including these terms alongside the traditional CAPM improves the performance of the model. Again, the merit of such procedures in improving the accuracy of the traditional CAPM should be a moot point in ROE proceedings given the inseparable connection between regulators' rulings and the observed returns from public utility stocks upon which the accuracy of the model is assessed. For an argument to prove availing in determining the awarded ROE, its economic logic should be transparent, understandable, and not dependent on data mining or otherwise circular reasoning. Unfortunately, this standard would disqualify most all of the tools regulators currently use to determine a utility's cost of equity.

F. State ROEs

Although FERC in Opinion 569 decided against consideration of ROEs authorized by state utility commissions in determining the ROE awarded to the MISO TOs, the Commission did not rule-out that such information could inform future ROE proceedings.[102] In response, the MISO TOs argued that the Commission's finding of a 9.88% ROE was arbitrary and capricious given that the midpoint of state ROEs for integrated utilities, which FERC found to be of lower risk than transmission companies, was 10.225% for the two years ending March 31, 2015.[103] In

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[101] Eugene F. Fama and Kenneth R. French, "The Capital Asset Pricing Model: Theory and Evidence" *Journal of Economic Perspectives*, Volume 18, Number 3 (Summer 2004): 39.

[102] Opinion No. 569, 169 FERC ¶ 61,129 at P 363-364 (2019).

[103] Request for Rehearing of the MISO Transmission Owners in Docket No. EL14-12-004 and Docket No. EL15-45-001 at 16.

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Opinion 569-A, the Commission reaffirmed its initial decision to not consider state ROEs, noting that the issue was partially ameliorated by the award of a higher 10.02% ROE and that it is not legally required to base transmission ROEs on state jurisdictional ROEs.[104]

Nonetheless, were regulators to dispose of the distorted methodologies typically used to determine utilities' cost of equity, it is likely that existing state-authorized ROEs would be used in a similar manner as by the MISO TOs to inveigh against any reductions. Such arguments would have it backwards, however. It is the methods currently practiced by regulators at both the federal and state/local level to determine awarded ROEs which are arbitrary and capricious, not the results which expose the fallacies behind their approaches. Given that regulators throughout the entirety of the U.S. establish their ROEs based on some combination of the erroneous framework adopted by FERC in Opinion 569, pointing to state ROEs as evidential of the just and reasonable ROE is just another example of self-perpetuating logic and should be dismissed.

G. Conclusions on the Just and Reasonable ROE

From the foregoing examination of FERC's methodology, there is not much which could be considered fair in the Commission's approach to ascertaining the truly just and reasonable ROE. The Expected Earnings model, Risk Premium methodology, and DCF model are all inherently circular and should have been rejected. The remaining model is the CAPM, but the Commission's misspecification of the model led to an excessively high estimate. A valid approach to the CAPM would have been to adopt values commonly used by the investment community for the risk-free rate and market risk premium, apply unadjusted betas to the market risk premium, and discard the baseless size premium adjustment. Using the average risk-free rate and market risk premium found in Fernandez, Ortiz Pizarro, and Fernandez Acin (2015) of 2.4%

[104] Opinion No. 569-A, 171 FERC ¶ 61,154 at P 167 (2020).

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and 5.5%, respectively, taking the average beta of 0.625 from the sample utilities after undoing the Value Line adjustment, and applying these parameters to equation (6) results in an estimate of 5.84%.

Utility representatives and regulators accustomed to significantly higher rates would probably scoff at the notion that this could be the just and reasonable ROE. The parties involved in Opinion 569 would likely point to FERC's low-end outlier test applied to the CAPM which excluded estimates below 6.47% as evidence to dismiss 5.84% as the fair ROE, although this threshold was notably based on Moody's average Baa Utility Bond Yield plus 20% of FERC's extreme 9.12% market risk premium; a prior iteration of the threshold merely added 100 basis points to the average Baa Utility Bond Yield, resulting in a 5.65% threshold.[105] In any case, a convergence of utility ROEs towards utility bond yields should not be viewed as untoward. Utility stocks are characteristically similar to bonds in that they provide a stable stream of income from a safe investment source, so a ~100 basis point premium to compensate for equity's incremental risk is a justifiable finding. Ultimately, the 5.84% fair ROE for public utilities comes from a proper implementation of the CAPM, which FERC acknowledged as the most common model for estimating the cost of equity.[106] [107] As such, it really should be that this standard

[105] Opinion No. 569, 169 FERC ¶ 61,129 at P 388 (2019).

[106] *Id.* at P 236. FERC cited "the CAPM is by far the most popular method of estimating the cost of equity capital." from John R. Graham and Campbell R. Harvey, *The theory and practice of corporate finance: Evidence from the field*, 60(2) Journal of Financial Economics 187, 201 (2001) and Michael C. Ehrhardt and Eugene F. Brigham, *Financial Management: Theory and Practice* 253 (13th ed. 2011) ("[T]he basic CAPM is still the most widely used method for thinking about required rates of return on stocks.").

[107] Notably, Professor Aswath Damodaran, using data as of January 2021 and an approach based on the standard CAPM, indicated that the cost of equity for general utilities was 4.42%. This estimate was driven by a relatively low risk-free rate of 0.93% and a market risk premium of 4.72%, although the beta for the industry was 0.74. See https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/wacc.html.

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application represents the starting point in determining a utility's cost of equity, with any adjustments requiring a rigorous explanation.

No matter the provision of objective information that demonstrates the fallacies which inform prevailing ROEs and the degree of their excessiveness, there is likely to be inertia on the part of regulators to award an ROE based on an intellectually justified analysis. Part of the issue would probably be a desire to maintain predictability in utility ratemaking and to approach changes gradually. A compromise approach could be to award the expected market return as suggested by the CAPM instead of the true required return. In the context of Opinion 569, this would have meant authorizing a 7.9% ROE vs. the actual award of 10.02%.[108] For the time being, a cut of ~200 basis points from the current level should strike a balance between maintaining gradualism in utility rate changes while still allowing for authorized ROEs to better reflect objective information. Nonetheless, there should be an acknowledged principle that awarded ROEs will continually approach the true just and reasonable ROE over time.

A final point on the just and reasonable ROE: some might assert that the awarded ROE should be set above the utility's cost of equity because the return realized through its levied rate charges may differ from the authorized ROE. This is a non-issue for the MISO TOs as their formula rate structure contains true-up provisions which ensure the recovery of the authorized ROE.[109] In jurisdictions without formula rates which guarantee the level of the earned ROE, it may be fair for regulators to consider the risk that a utility may not earn its cost of equity and assess this in the awarded ROE. However, given that utilities are currently authorized ROEs well

[108] Fernandez, Ortiz Pizarro, and Fernandez Acin (2015) indicated a 2.4% risk-free rate and a 5.5% market risk premium for the U.S., resulting in a 7.9% expected market return.

[109] Rebuttal Testimony and Exhibits of J. Bertram Solomon on behalf of the Joint Customer Intervenors in Docket No. EL14-12-000 at 12.

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above their cost of equity, the difference between earned ROEs and authorized ROEs is a moot observation until authorized ROEs approach the actual cost of equity.

III. Related Issues

A. Capital Structure

In addition to the cost of equity, the composition of the utility's assets funded by debt and equity, or the capital structure, must be considered to determine a utility's overall required return. Although the MISO TOs' capital structure was not in the purview of the Opinion 569 proceedings, state commissions often rule on the authorized capital structure in conjunction with setting the ROE to establish the overall rate of return. The common formula for setting the overall rate of return, otherwise known as the Weighted Average Cost of Capital ("WACC"), is as follows:[110]

$$(8)\ \mathrm{WACC} = r_D * \frac{D}{V} + r_E * \frac{E}{V}$$

where: r_D = cost of debt
r_E = cost of equity
D = value of debt
E = value of equity
V = D + E

In setting utility rates, the WACC is applied to the book value of the rate base, so D, E, and V in equation (8) represent book values. The cost of debt, r_D, is represented by the market rate of interest in the traditional WACC formula, but for purposes of utility ratemaking it is typically the embedded cost of debt which is the utility's actual interest cost based on its outstanding bond

[110] Preferred stock is ignored for simplicity.

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issues.[111] Interest on corporate debt is tax deductible, so r_D is usually arrived at by applying a (1 – T) factor to the embedded cost of debt, where T is the corporate tax rate.

There are factors which favor the use of debt in a utility's capital structure. Clearly, the tax deductibility of interest expense lowers the revenue requirement in a way which equity does not. Utilities' cost of debt is also currently much lower than awarded ROEs; Moody's average Baa Utility Bond Yield was 4.65% for the MISO I period from January-June 2015 and was 5.41% for the MISO II period from July-December 2015.[112] [113] The conventional wisdom, however, is that the effect of rebalancing the capital structure to include more debt, or "leveraging", is to magnify the firm's profit or loss. Leveraging increases the volatility of returns to shareholders which implies an increased cost of equity and in turn reduces the benefit from debt in lowering the overall cost of capital.

It's commonplace for commissions to authorize overall rates of return using a ~50% debt, ~50% equity capital structure; the MISO TOs' average capital structure was 52.4% equity per Attachment O of the MISO Tariff as of January 2015.[114] Given the advantages of debt, it seems reasonable that commissions would authorize capital structures weighted towards debt in order to minimize the overall cost of capital. Critics, however, would likely reference the framework set forth by Modigliani and Miller (1958) who found that the value of the firm is

[111] The use of embedded interest cost prevents windfall profits/losses to shareholders. If the market rate of interest exceeds the embedded interest cost, the utility would over-collect on its debt expense and the surplus would accrue to shareholders. If the market rate of interest is less than embedded cost, the utility would under-collect on its debt expense and shareholders would incur a loss as debtholders have a primary claim on the firm's earnings.

[112] Opinion No. 569, 169 FERC ¶ 61,129 at P 380 (2019).

[113] As of 1/13/2021, Moody's Season Baa Corporate Yield was 3.5%. See "Moody's Season Baa Corporate Yield", FRED Economic Data, https://fred.stlouisfed.org/series/DBAA.

[114] Brief of the Joint Complainants in Docket No. EL14-12-002 at Exhibit JC-3, citing Attachment O of the MISO Tariff filed January 2015.

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independent of the capital structure selected by its management. A proposition from their work was that the cost of equity relates proportionally to the debt-to-equity (D/E) ratio as described by the following equation:[115]

$$(9)\ \mathrm{r_e} = \rho + (1 - \tau)(\rho - i)\frac{\mathrm{D}}{\mathrm{E}}$$

where: r_e = cost of equity
ρ = unlevered cost of equity
τ = corporate tax rate
i = current market rate of interest on debt
D/E = debt-to-equity ratio

Note that the cost of equity, r_e, equals the unlevered cost of equity, ρ, when D/E = 0 or when the firm has no debt and is entirely financed by equity. In accepting this framework, the impact of changes to the D/E ratio on the utility's cost of equity can be assessed. Using equation (9), Exhibit V of the Appendix indicates the effect of increased debt levels on the MISO TOs' cost of equity as well as on their overall cost of capital. The i term is 4.65% per Moody's Baa Utility Bond Yield during the MISO I period. To illustrate how differing corporate tax rates affect the advantage from debt financing, examples where τ = 0%, 21%, and 35% are provided.[116] The unlevered cost of equity, ρ, can be imputed using these parameters and when given the cost of equity, r_e, at the current debt level. Of course, the cost of equity was the central controversy of the Opinion 569 proceedings, so three estimates are shown: the first row is the cost of equity at increasing leverage ratios as represented by the true just and reasonable cost of equity where r_e is 6% when the D/E ratio = 1, the third row represents the cost of equity as

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115 This equation results from their updated 1963 analysis which reflects the tax advantage of debt financing; Franco Modigliani and Merton H. Miller, "Corporate Income Taxes and the Cost of Capital: A Correction" *The American Economic Review*, Vol. 53, No. 3 (June 1963): 439.

116 τ = 0% reflects the scenario where there is no tax advantage to debt financing, τ = 21% reflects the corporate tax rate as of 2021, and τ = 35% reflects the corporate tax rate in 2015.

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determined by FERC in Opinion 569 where r_e is 10% when the D/E ratio = 1, and the second row represents the midpoint where r_e is 8% when the D/E ratio = 1. The below Table II shows the example where τ = 21%.

Table II: Cost of Equity vs Debt % of Capital Structure where τ = 21%

D/E Ratio	1	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
Debt %	50%	56%	60%	64%	67%	69%	71%	73%	75%
Unlevered Cost of Equity									
5.40%	6.00%	6.15%	6.30%	6.45%	6.60%	6.74%	6.89%	7.04%	7.19%
6.52%	8.00%	8.37%	8.74%	9.11%	9.48%	9.85%	10.22%	10.59%	10.69%
7.64%	10.00%	10.59%	11.18%	11.77%	12.36%	12.95%	13.54%	14.13%	14.72%
Total Cost of Capital									
	4.84%	4.77%	4.72%	4.68%	4.65%	4.62%	4.59%	4.57%	4.55%
	5.84%	5.76%	5.70%	5.65%	5.61%	5.57%	5.54%	5.52%	5.49%
	6.84%	6.75%	6.68%	6.62%	6.57%	6.53%	6.49%	6.46%	6.44%

As shown, the rate at which the cost of equity rises with the D/E ratio depends on the assumed cost of equity. For the 6% estimate, every 0.25 increase in the D/E ratio increases the cost of equity by 15 basis points while for the 10% estimate the cost of equity rises by 59 basis points. Notably, the total cost of capital declines as more debt is added due to the tax deductibility of interest expense. Some might argue that the risk of financial distress would eventually offset the tax advantage of debt at higher D/E ratios and raise the overall cost of capital, but this seems implausible in the case of public utilities over the range shown above, especially when considering a modest increase in the D/E ratio to 1.25 or 1.5.[117] Thus, even if one strictly adheres to the Modigliani-Miller ("MM") model, there's reason to uphold that utilities' overall cost of capital would be lowered by increased debt levels.

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[117] Some might further argue that the market interest expense increases with the D/E ratio even if the D/E is below the level where financial distress risk is a factor. This is perhaps valid, but the *i* term in equation (9) would also increase and the cost of equity would increase at a lower rate. Thus, the effect of increased debt levels on the overall cost of capital is much the same as shown in Table II.

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The results from the MM approach, however, should be viewed with a pound of salt. For one, while the MM framework asserts that the value of the firm is independent of its underlying capital structure (at least when ignoring the tax advantage of debt), it's doubtful this much applies to public utilities where the firm's operating income is a direct function of its authorized capital structure. As equity has a higher cost than debt, an obvious way for the utility to accumulate more earnings is to weigh the capital structure towards equity as the regulator allows the utility to pass through its approved costs to ratepayers. Moreover, the relationship between the D/E ratio and the cost of equity as shown in equation (9) stretches credulity when applied to public utilities as regulation functions to reduce the volatility of expected returns to shareholders. The proposition in that equation as applied to the MISO TOs is made transparently frivolous by their governing tariff whereby the authorized level of profit is guaranteed; the outcomes predicted by MM are simply irrelevant when regulation explicitly collapses the variability of expected returns to zero.

Critics of the declining overall capital cost shown in Table II might appeal to Miller (1977)[118] where the effect of personal taxes was shown to offset the benefit of interest deductibility at the corporate level given that dividends and capital gains are taxed at a lower rate than interest income. This personal tax difference is perhaps a compelling explanation, or at least one reason, for why corporations generally don't avail themselves of debt financing to the extent predicted by the MM model with corporate income taxes. To repeat a theme, whatever the merit of this rationale for the general firm, it's inapplicable to utility regulation. Utility investors may indeed favor the payout of operating income through equity for personal tax reasons. It follows that, even if the total cost of capital at the corporate level is lowered by debt in the manner shown

[118] The same Merton H. Miller of Modigliani-Miller.

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in Table II, investors will inveigh on behalf of an authorized capital structure tilted towards equity because this ultimately maximizes their personal income. However, as substantiated by FERC in Opinion 569, the goal of regulation is not to maximize the value of the firm for investors, it's to approve prices which are just and reasonable. What matters is the cost of capital at the corporate level because this indicates the cost *to ratepayers* of financing the utility's rate base; how things shake out for investors after personal taxes should be moot from a regulatory perspective. Furthermore, the effect of personal taxes should not be viewed as implicating the estimated cost of debt or equity used in the WACC formula considering that personal tax effects are already impounded into observed yields from capital markets.[119]

In all practicality, financial theory gives limited insight into determining the just and reasonable capital structure for a public utility. It's the role of regulators to understand the utility's relevant financial information, appropriately assess its business risk, and make a ruling on whether more debt can be accommodated or if leverage should be reduced from existing levels. The data from the MISO TOs once again provides insight into the efficacy of the current regulatory paradigm. In this vein, it's worthwhile to hypothesize on the effect of, and assuming all else equal, an increase in the MISO TOs' authorized D/E ratio from 1 to 1.25.[120] According to Table II, when generously assuming FERC's 10% allowed ROE represents the true cost of equity when D/E = 1, the discount rate for the MISO TOs would increase from 10% to 10.59%. Presuming that the authorized ROE of 10% remains intact, the share price of the MISO TOs will fall to account for the increased risk and no offsetting expectation of increased income.

[119] The yield on municipal bonds is a notable example of how the effect of personal taxes is incorporated in observed rates of return. The interest income on municipal bonds is generally exempt from federal taxes, so a lower yield is required from these securities, at least from investors who face taxes on interest income. This sort of effect can be thought of as implicit in any observed yield.

[120] It is the purview of the MISO TOs' state jurisdictional commissions to rule on their authorized capital structure.

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But so what? Assuming the MISO TOs have similar M/B ratios as shown in Figure I, the fall in share price won't be enough to drive market value below book value and threaten the MISO TOs' ability to fund transmission assets. In the meantime, ratepayers would enjoy a lower cost of capital as less expensive debt is substituted for equity and there is no attendant increase in the ROE collected through rates. Even if FERC reacts to increase the allowed ROE to 10.59% to account for the higher leverage, the cost of capital would still be lower than before because of the tax advantage of debt. The foregoing analysis remains under the auspices of MM which, as it is applied in the context of regulated utilities, makes dubious assumptions about the way investors react to increased leverage. In all likelihood, such moderate increases in the level of debt won't have much bearing on how investors price the stock of the MISO TOs, almost certainly not to the extent indicated in Table II considering the MISO tariff guarantees that the authorized ROE is recovered, and ratepayers would reap an arbitrage gain from higher leverage. To summarize, all signs indicate that regulators have been too deferential to investor interests when considering authorized capital structures. The issue is even more salient under the current regime where allowed costs of utility equity are more than twice as high as debt.[121] Given the stability afforded to public utilities by virtue of their monopoly status, the tax advantage and relative cheapness of debt, and that currently allowed ROEs far exceed the true cost of equity, it would be prudent for regulators to gradually authorize higher debt ratios.

However, advocates of investor interests have an escape hatch available in the form of ratings agencies, such as Moody's Investors Service and S&P Global Ratings, which opine on the financial integrity of utility companies. A complete review of those firms' methodologies for

[121] Assuming the utility's market interest cost is 4.65% and the utility ROE is 10%, equity is 2.72x as expensive as debt at the margin: 10/(4.65*(1-.21)) = 2.72.

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rating utility debt is a subject for further research, but there is reason to doubt fair treatment would be conferred to utilities awarded, per a more justified assessment of capital costs, a lower ROE or authorized a capital structure with higher debt. For example, in the summer of 2018, Moody's changed its utility sector outlook from "stable" to "negative", citing the impact of the recent change in the corporate tax rate on the lowering of cash-flow to interest coverage ratios.[122] Apparently, at least in the eyes of that ratings firm, reduced revenue is viewed unfavorably even when it results from the government explicitly lowering the expenses a utility is required to collect from its customers.

It's thus no stretch to imagine that reductions to the ROE will be viewed in a similarly contemptuous manner. Even if unfair, the ability of ratings firms to influence the cost of debt is an outcome to be reckoned with in ROE proceedings. Ratings agencies are private corporations outside the purview of utility regulators, so it may be that a degree of acquiescence to their unfounded standards must be conceded when ultimately deciding on the authorized ROE and/or capital structure. Nonetheless, the recognition of a legitimate constraint in moving towards the truly just and reasonable ROE would at least ground the ROE proceedings in a meaningful discussion in contrast to, and hopefully in replacement of, endless debate on irrelevant financial methodology.

B. ROE Incentives

In addition to the determination of the base ROE for the MISO TOs in Opinion 569, FERC capped transmission incentive adders to the base ROE at 12.62% per the average of the

[122] Peter Maloney, "Moody's goes negative on regulated utilities for first time, citing tax law impacts," Utility Dive, June 19, 2018, https://www.utilitydive.com/news/moodys-goes-negative-on-regulated-utilities-for-first-time-citing-tax-law/525971/.

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upper end of the zone reasonableness indicated by the Risk Premium methodology, DCF model, and CAPM.[123] Such rewards are ostensibly required to incentivize socially desired investments which enhance reliability and/or reduce congestion on transmission lines. Presuming this rationale continues to be upheld, incentives should be made to reflect the true just and reasonable ROE, which indeed means that the incentive cap should likewise be significantly lowered from current levels.

Years of stagnant real investment in transmission infrastructure along with the 2003 Northeast blackout motivated the issuance of FERC Order 679 in July 2006 which was intended to promote transmission investment through incentive-based rates. The order stipulated that the incentive rates were subject to the same requirements which condition the base ROE to be just and reasonable.[124] For the MISO TOs, this meant that the base ROE, established at 12.38% in 2002, plus incentives was capped at 15.69% until Opinion 551 came into effect as of September 28, 2016, with a refund period from November 13, 2013 through February 11, 2015.[125] As indicated herein, FERC's methodology resulted in excessive base ROEs. As such, certain commenters to Order 679 were correct in suggesting that incentive rates were unnecessary as the existing base ROEs were adequate to induce transmission investment. In other words, the award of incentive adders can be seen as a giveaway on top of a giveaway as the base ROE already exceeds transmission utilities' cost of equity.

There are explanations besides ROE incentives for the transmission build-out which occurred starting in the early 2000s. For example, efforts which undoubtedly led to transmission

[123] Opinion No. 569-A, 171 FERC ¶ 61,154 at P 268 (2020).

[124] Order No. 679, 116 FERC ¶ 61,057 (2006) at P 8.

[125] Opinion No. 551, 156 FERC ¶ 61,234 at page 125 (2016).

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upgrades were enhanced NERC reliability standards and FERC Orders 890 and 1000 which culminated in regional planning processes to identify and relieve transmission constraints through transmission expansion planning as well as mechanisms to ensure the allocation of costs to all beneficiaries of system upgrades. The need for ROE adders to incentivize transmission build-out should be viewed doubtfully in the context of when the entire region, including the system operator (e.g. MISO, PJM), collaborates to identify the projects which most effectively improve reliability and/or reduce congestion, and moreover when regional cost-sharing spreads the risk from complex projects which span multiple jurisdictions.

In summary, when considering that the utility cost of equity is far lower than the base ROE which is typically awarded, the justification for transmission ROE incentive adders stemmed from the mistaken belief that the base ROE was insufficient to attract transmission investment. Some, however, argue that an ROE above a utility's cost of equity is necessary to stimulate investment. For example, Kihm et al. (2015) provided the following perspective:

> To be clear, we are not suggesting in principle it is inappropriate for a utility to be allowed to earn an equity return in excess of the cost of equity—to the contrary, the return on equity *should* exceed the cost of equity, just as it does for the typical non regulated company. In fact, that is the only way that firms can create value for their investors. Our recommendation is that utility regulators connect this engine of shareholder-value creation more closely to customer- and societal-value creation. A utility earning a rate of return in the ten percent range is earning noticeably more than its cost of equity on every investment. The implications here are important. This system of compensation is predicated on the assumption that nearly all, if not all, **utilities are creating investor value every time they make capital investments**. That may have been appropriate when the primary social goal of the utility sector was to grow enough to provide universal service, and economies of scale were clear.[126]

[126] Steve Kihm, Ron Lehr, Sonia Aggarwal, and Edward Burgess, "You Get What You Pay For: Moving Toward Value in Utility Compensation" June 2015 at 4-5. Available at https://docs.cpuc.ca.gov/PublishedDocs/Efile. Emphasis appears as in the source.

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Whether utility investment is predicated upon the award of an ROE *above* the cost of equity is a separate debate from the ruling in Order 569 as the Commission contended that the estimated cost of equity upon which the ROE was based is sufficient to attract capital.[127] Arguing that the 10.02% ROE is needed because it's *higher* than the cost of equity would be shifting the goalposts. Moreover, an aspect which merits higher regard in the discussion on incentives is the fact that a public utility has a statutory obligation to serve customers who pay its rates. An "engine of shareholder value creation" already exists from this arrangement in that utility shareholders are entitled to regulated profits in exchange for having a monopoly over the provision of an essential public good. It is indeed unfortunate that this government-approved relationship, which produces a safe investment for capital, seems to have no practical bearing on the level of profit awarded by regulators. Not only do utilities receive base ROEs that make their profits commensurate with average-risk firms, an observation at-odds with economic logic as utilities enjoy regulatory backing unexperienced in most industries, commissions feel the need to doubly reward them by tacking on additional ROE incentives.

Some would perhaps suggest that while an ROE set at the cost of equity is a fair approach to maintain baseline service, goals such as those envisioned in regional transmission expansion involve specialized innovation which could not be achieved but for the award of economic profit. Such claims should be level-set with the reality that base ROEs already far-exceed the cost of equity for utilities. In this sense, ROE adders merely exacerbate the outcome described by Averch and Johnson (1962) whereby regulated firms allocate resources inefficiently towards capital investment when the allowed rate of return exceeds the cost of capital. This "gold-plating" effect at least reduces the degree of supposed efficiency gains from ROE incentives as

[127] Opinion No. 569, 169 FERC ¶ 61,129 at P 31 (2019).

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utilities are further encouraged to pursue capital intensive projects when alternatives, such as energy efficiency programs or demand response, would provide a more optimal societal solution. In conclusion, before deciding that ROE adders are needed to spur investment, more consideration needs to be accorded to utilities' special relationship with the public and that the attendant regulatory environment diminishes the need for incentives which are applicable to relatively competitive firms. In any case, whether or not ROE incentives are perceived as availing in the achievement of specific policy goals, it's necessary that regulators be able to fairly assess the level of the just and reasonable base ROE to obtain the desired outcomes without giving unduly preferential treatment to utility shareholders. Unfortunately, regulators have fallen short in this fundamental task.

IV. Conclusion

As demonstrated in this paper, what is portrayed as technical financial analysis in utility ROE proceedings most often serves to employ self-fulfilling methodology so that preconceived notions are upheld, with perhaps a few tweaks to somewhat incorporate prevailing interest rates into the final result and thus sustain credibility. Circular logic renders the traditional models besides the CAPM moot for determining the utility cost of equity. It follows that approaching the fair ROE involves an application of the CAPM where an expected overall market return is developed, using expectations realistically adopted by the broad investment community, and then appropriately discounted to reflect the low-risk nature of the public utility business. Adopting this more reasoned approach will not be straightforward. Generations of utility regulators and financial analysts have become inculcated in the idea, at least implicitly, that utilities are fairly compensated with an ROE similar to that expected from the average firm. Because of this, there will be inertia in moving towards the truly just and reasonable ROE. Even if an honest technical

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application which revealed a significantly lower cost of equity were to become accepted, factors extraneous to financial models would likely take on a more prominent role in militating against decreases to the ROE. As Commissioner Richard Glick, who is Chairman of FERC at the time of this writing, noted in his statement concurring in part and dissenting in part to Opinion 569-A:

> To be fair, I am sympathetic to the impulse to consider subjective factors. The Commission's approach to setting a just and reasonable ROE will often implicate broader policy considerations, equity, and other factors that cannot be captured in, for example, a discussion of dividend yields or the appropriate sources of growth rate calculations. But while ROE policy will always be as much art as science, that is no excuse to pretend that art is science.
>
> If broader considerations, including policy goals, are preventing the Commission from settling on or consistently applying an ROE methodology, then we must acknowledge those goals and give the interested entities the chance to weigh in on them just as they do for the intricacies of dividend yields, growth rates, and the like.[128]

Commissioner Glick's statement offers guidance to a preferable future state of ROE proceedings. Regarding the "science" aspect, much of the time spent litigating the traditional models can be dispensed in favor of a simple application of the CAPM. Then, the "art" of incorporating broader policy implications can be considered before ultimately awarding the ROE. One of the policy factors is undoubtedly how ratings agencies would react to utilities' lower profit levels. Although the opinions emanating from those firms are likely to allege the increased riskiness of utility debt using similarly distorted logic as what supports the prevailing ROE methodology, this is a legitimate concern to recognize as bond ratings influence the cost of debt. In consideration of this, an attempt to engender fairness in setting the ROE should probably focus on a ruling from FERC as it has interstate jurisdiction; this would prevent ratings agencies from unfairly singling out state commissions which authorize lower returns. Over time, as it

[128] Statement of Commissioner Richard Glick, concurring in part and dissenting in part in *Association of Businesses Advocating Tariff Equity v. Midcontinent Independent System Operator, Inc.*, Opinion No. 569-A, 171 FERC ¶ 61,154 at P 9-10 (2020).

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becomes clear that the protestations to reduced ROEs were overwrought, state commissions wouldn't have the standing to continue outmoded methodologies and their approaches would converge towards the truly just and reasonable ROE.

Nonetheless, any "subjective factors" should be viewed skeptically given the current litany of biased practices used to formulate ROEs. There should be acknowledgement that the standards enumerated in *Hope* and *Bluefield* were never realized in an objective sense and this should motivate a fundamental change towards fairness on behalf of regulators, meaning that the self-fulfilling methodology used to uphold the status quo should be discarded. Ultimately, it seems indisputable that ensuring fairness in outcomes depends on acceptance of objective evidence and data rather than appeals to subjective information. The public can judge the efficacy of future ROE proceedings by the degree to which this principle is upheld.

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Appendix

Supporting data and calculations for the Figures and Exhibits in this analysis are made available at https://github.com/tsikes37/Regulated-Inequity-Repository

Exhibit I: FERC's Risk Premium Results and Inputs

Source: Opinion No. 569-A, 171 FERC ¶ 61,154 Appendix I (2020)

Risk Premium Results

Current Equity Risk Premium	MISO I	MISO II
Average Base ROE Over Study Period	10.53%	10.48%
Average Yield Over Study Period	6.10%	6.02%
Baa Utility Bond Yield	4.65%	5.41%
Change in Bond Yield	-1.45%	-0.61%
Risk Premium/Interest Rate Relationship	-0.7006	-0.6866
Adjustment to Average Risk	1.02%	0.42%
Average Risk Premium over Study Period	4.43%	4.46%
Adjusted Risk Premium	**5.45%**	**4.88%**
Implied Cost of Equity		
Baa Utility Bond Yield	4.65%	5.41%
Adjusted Equity Risk Premium	5.45%	4.88%
Risk Premium Cost of Equity	**10.10%**	**10.29%**

Risk Premium Inputs

Docket Number	Utility	Type	Date	Base ROE	Baa Bond Yield	Implied Risk Premium
ER05- 515	BG&E	Settlement - Uncontested	Feb-06	10.80	6.07	4.73
ER05- 515	BG&E	Settlement - Uncontested	Feb-06	11.30	6.07	5.23
ER05- 925	Westar	Settlement - Uncontested	Jun-06	10.80	6.36	4.44
ER07- 284	SDG&E	Settlement - Uncontested	Feb-07	11.35	6.14	5.21
ER06- 787	Idaho Pwr	Settlement - Uncontested	May-07	10.70	6.15	4.55
ER06- 1320	Wisconsin Elec. Pwr	Settlement - Uncontested	May-07	11.00	6.15	4.85
ER07- 583	Commonwealth Edison	Settlement - Uncontested	Sep-07	11.00	6.41	4.59

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ER06- 1549	Duquesne	Settlement - Uncontested	Sep-07	10.90	6.41	4.49
ER08-92	VEPCO	Order	Oct-07	10.90	6.43	4.47
ER08- 374	Atlantic Path	Order	Nov-07	10.65	6.44	4.21
ER08- 413	Startrans IO	Order	Nov-07	10.65	6.44	4.21
ER08- 396	Westar	Declaratory order.	Nov-07	10.80	6.44	4.36
ER08- 686	Pepco Holdings	Order	Jan-08	11.30	6.41	4.89
ER07- 562	Allegheny	Settlement	Feb-08	11.20	6.42	4.78
ER07- 1142	Ariz. Pub. Service	Settlement - uncontested	Apr-08	10.75	6.54	4.21
ER08- 1207	VEPCO	Order	May-08	10.90	6.62	4.28
ER08- 1402	Duqesne	Order	Jun-08	10.90	6.69	4.21
ER08- 1423	Pepco Holdings	Order	Jun-08	10.80	6.69	4.11
ER08- 1584	Black Hlls	Settlement - Uncontested	Jun-08	10.80	6.69	4.11
ER09- 35/36	Tallgrass / Prairie Wind	Commission Order	Jul-08	10.80	6.80	4.00
ER09- 249	Public Service Elec. & Gas	Accepted by FERC	Aug-08	11.18	6.86	4.32
ER09- 548	ITC Great Plains	Settlement - Uncontested	Sep-08	10.66	6.94	3.72
ER09-75	Pioneer	Order	Sep-08	10.54	6.94	3.60
ER09- 187	SoCal Edison	Order on Paper Hearing	Sep-08	10.04	6.94	3.10
ER08- 375	SoCal Edison	Order on Paper Hearing	Nov-08	10.55	7.60	2.95
ER09- 745	Baltimore Gas & Elec.	Accepted by FERC	Dec-08	11.30	7.80	3.50
ER07- 1069	AEP - SPP Zone	Settlement - Uncontested	Jan-09	10.70	7.95	2.75
ER09- 681	Green Power Express	Commission Order	Jan-09	10.78	7.95	2.83
ER08- 281	Oklahoma Gas & Elec.	Settlement - Uncontested	Apr-09	10.60	8.13	2.47
ER08- 1457	PPL Elec. Utilities Corp.	Settlement - Uncontested	Apr-09	11.00	8.13	2.87
ER08- 1457	PPL Elec. Utilities Corp.	Settlement - Uncontested	Apr-09	11.14	8.13	3.01
ER08- 1588	Kentucky Utilities Co.	Settlement - Uncontested	Apr-09	11.00	8.13	2.87
ER08- 552	Niagara Mohawk	Settlement - Uncontested	Jul-09	11.00	7.62	3.38
ER09- 628	National Grid Generation LLC	Settlement - Uncontested	Aug-09	10.75	7.39	3.36
ER08- 313	Southwestern Public Service Co.	Settlement - Uncontested	Aug-09	10.77	7.39	3.38
ER10- 160	SoCal Edison	Order on Paper Hearing	Sep-09	10.33	7.08	3.25
ER08- 1329	AEP - PJM Zone	Settlement - Uncontested	Mar-10	10.99	6.20	4.79
ER10- 230	Kansas City Power & Light Co.	Settlement - Uncontested	Aug-10	10.60	6.05	4.56
ER10- 355	AEP Transcos - PJM	Settlement - Contested	Aug-10	10.99	6.05	4.95
ER10- 355	AEP Transcos - SPP	Settlement - Contested	Aug-10	10.70	6.05	4.66
ER11- 1952	SoCal Edison	Order	Sep-10	10.30	5.93	4.37
EL11-13	Atlantic Grid Operations	Declaratory Order	Oct-10	10.09	5.84	4.26
ER11- 2895	Duke Energy Carolinas	Settlement - Initial Filing	Oct-10	10.20	5.84	4.37
ER11- 2377	Northern Pass Tx	Order	Nov-10	10.40	5.79	4.62
ER12- 2300	PSCo	Order	Nov-10	10.25	5.79	4.47

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ER10- 1377	Northern States Power Co. (MN)	Settlement - Uncontested	Mar-11	10.40	5.94	4.46
ER10- 992	Northern States Power Co.	Settlement - Uncontested	Apr-11	10.20	6.00	4.20
ER10- 516	South Carolina Electric and Gas	Settlement - Uncontested	Apr-11	10.55	6.00	4.55
ER11- 4069	RITELine	Order	May-11	9.93	5.98	3.95
ER12- 296	PSEG	Order	Aug-11	11.18	5.71	5.47
ER08- 386	PATH	Settlement - uncontested	Sep-11	10.40	5.57	4.83
ER11- 2560	Entergy Arkansas, Inc.	Settlement - Uncontested	Dec-11	10.20	5.21	4.99
ER11- 2853	PSCo	Settlement - Uncontested	Mar-12	10.10	5.08	5.03
ER11- 2853	PSCo	Settlement - Uncontested	Mar-12	10.40	5.08	5.33
ER12- 1378	Cleco	Settlement - Uncontested	Nov-12	10.50	4.74	5.77
ER12- 2554	Transource Missouri	Settlement - Uncontested	Jan-13	9.80	4.65	5.16
ER12- 778	Puget Sound Energy	Settlement - Uncontested	Jan-13	9.80	4.65	5.16
ER12- 778	Puget Sound Energy	Settlement - Uncontested	Jan-13	10.30	4.65	5.66
ER11- 3643	PacifiCorp Inc.	Settlement - Uncontested	Feb-13	9.80	4.62	5.18
ER12- 1650	Maine Public Service Co.	Settlement - Uncontested	Feb-13	9.75	4.62	5.13
ER11- 3697	SoCal Edison	Settlement - Uncontested	Jul-13	9.30	4.82	4.49
ER13- 941	San Diego Gas and Electric	Settlement - Uncontested	Jan-14	9.55	5.22	4.33
ER12- 1589	PSCo	Settlement	Aug-14	9.72	4.76	4.96
ER12-91	Duke Energy Ohio	Settlement - Uncontested	Sep-14	10.88	4.73	6.15
EL12- 101	Niagara Mohawk	Settlement - Uncontested	Jan-15	9.80	4.66	5.14
ER13- 685	Public Service Company New Mexico	Settlement - Uncontested	Feb-15	10.00	4.62	5.38
ER14- 1661	MidAmerican Central California	Settlement - Uncontested	Mar-15	9.80	4.58	5.22
ER15- 303	American Transmission Systems, Inc.	Settlement - Uncontested	May-15	9.88	4.58	5.30
ER15- 303	American Transmission Systems, Inc.	Settlement - Uncontested	May-15	10.56	4.58	5.98
EL14-93	Westar Energy	Settlement - Uncontested	May-15	9.80	4.58	5.22
EL12-39	Duke Energy Florida	Settlement - Uncontested	Jun-15	10.00	4.65	5.35
ER14- 192	SPS	Settlement - Uncontested	Jul-15	10.00	4.79	5.21
ER13- 2428	Kentucky Utilities	Settlement - Uncontested	Jul-15	10.25	4.79	5.46
ER14- 2751	XEST	Settlement - Uncontested	Sep-15	10.20	5.07	5.13
ER15- 572	New York Transco LLC	Settlement - Uncontested	Oct-15	9.50	5.23	4.27
ER15- 2237	Kanstar Transmission LLC	Settlement - Uncontested	Dec-15	9.80	5.41	4.39
ER15- 2114	Transource West Virginia	Settlement - Uncontested	Dec-15	10.00	5.41	4.59

Highlighted rows apply to MISO II results only

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FERC at P 111 of Opinion 569-A indicated the period for the Baa Bond Yield: “We continue to find that the risk premiums should not contain inconsistent dates for the ROEs and for the bond yields. Rather, they should be aligned by corresponding the ROE to the test periods on which it is based. For settlements, the relevant date is the date that parties file the settlement, not when the Commission approves it. Consequently, the six-month time period bond yields should be the six months preceding the settlements. Such information is reflected in the data in Appendix I.”

Exhibit II: Utility Proxy Group CAPM Stats

Company	Ticker	Beta Series Start Date	Avg Beta	Avg Adj Beta	2015 Adj Beta	Avg Annual Return	Value Line Beta	Size Adjustment
Ameren Corporation	AEE	12/27/2002	0.56	0.71	0.69	0.09	0.75	0.91%
American Electric Power Company, Inc.	AEP	12/24/1970	0.58	0.72	0.65	0.10	0.7	-0.36%
ALLETE, Inc.	ALE	4/17/1978	0.52	0.68	0.76	0.10	0.8	1.74%
Avista Corporation	AVA	2/15/1978	0.51	0.67	0.75	0.09	0.8	1.74%
Black Hills Corporation	BKH	2/15/1978	0.55	0.70	0.86	0.14	0.95	1.74%
CMS Energy Corporation	CMS	2/15/1978	0.66	0.78	0.70	0.11	0.75	0.91%
CenterPoint Energy, Inc.	CNP	12/24/1970	0.63	0.75	0.75	0.10	0.8	0.91%
Dominion Energy, Inc.	D	3/29/1985	0.48	0.65	0.63	0.15	0.7	-0.36%
DTE Energy Company	DTE	12/24/1970	0.53	0.68	0.70	0.12	0.75	0.63%
Duke Energy Corporation	DUK	3/29/1985	0.51	0.68	0.55	0.13	0.6	-0.36%
Consolidated Edison, Inc.	ED	12/24/1970	0.50	0.67	0.53	0.13	0.6	0.63%
Empire District Electric Co.	EDE	Inactive Price Series					0.70	1.71%
El Paso Electric Co.	EE	Inactive Price Series					0.70	1.71%
Edison International	EIX	4/17/1978	0.60	0.73	0.68	0.14	0.75	0.63%

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Eversource Energy	ES	2/15/1978	0.49	0.66	0.68	0.11	0.75	0.63%
Entergy Corporation	ETR	5/20/1977	0.61	0.74	0.66	0.12	0.7	0.63%
Exelon Corporation	EXC	4/17/1978	0.52	0.68	0.64	0.14	0.7	-0.36%
FirstEnergy Corp.	FE	11/8/2002	0.57	0.71	0.67	0.07	0.7	0.63%
Great Plains Energy Inc.	GXP	Inactive Price Series					0.85	1.06%
IDACORP, Inc.	IDA	2/15/1978	0.55	0.70	0.79	0.10	0.8	1.60%
ITC Holdings Corp	ITC	Inactive Price Series					0.65	1.06%
Alliant Energy Corporation	LNT	2/15/1978	0.49	0.66	0.73	0.11	0.8	0.91%
NextEra Energy, Inc.	NEE	2/15/1978	0.54	0.69	0.68	0.15	0.75	-0.36%
NorthWestern Corporation	NWE	12/21/2012	0.63	0.76	0.75	0.11	0.7	1.74%
OGE Energy Corp.	OGE	2/15/1978	0.53	0.69	0.79	0.10	0.9	0.91%
Otter Tail Corporation	OTTR	2/15/1978	0.52	0.68	0.82	0.10	0.9	1.71%
PG&E Corporation	PCG	5/20/1977	0.53	0.68	0.58	0.09	0.65	-0.36%
Public Service Enterprise Group Incorporated	PEG	12/24/1984	0.61	0.74	0.70	0.15	0.75	0.63%
PNM Resources, Inc.	PNM	2/15/1978	0.62	0.75	0.76	0.09	0.85	1.74%
Pinnacle West Capital Corporation	PNW	2/15/1978	0.55	0.70	0.71	0.09	0.7	0.91%
Portland General Electric Company	POR	3/25/2011	0.55	0.70	0.72	0.08	0.8	1.60%
PPL Corporation	PPL	3/29/1985	0.53	0.69	0.60	0.13	0.65	0.63%
SCANA Corp.	SCG	Inactive Price Series					0.75	0.91%

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The Southern Company	SO	1/2/1987	0.41	0.61	0.52	0.15	0.6	-0.36%
Sempra	SRE	6/27/2003	0.67	0.78	0.74	0.14	0.8	-0.36%
TECO Energy, Inc.	TE	Inactive Price Series					0.85	1.06%
UIL Holdings Corp.	UIL	Inactive Price Series					0.80	1.60%
Vectren Corp.	VVC	Inactive Price Series					0.80	1.60%
Westar Energy, Inc.	WR	Inactive Price Series					0.75	1.06%
Xcel Energy Inc.	XEL	2/15/1978	0.50	0.67	0.60	0.12	0.65	0.63%
AVERAGE			**0.55**	**0.70**	**0.69**	**11.35%**	**0.75**	

- Beta Series Start Date, Avg Beta, Avg Adj Beta, and 2015 Adj Beta are calculated using data downloaded from Yahoo Finance.
    - Some companies in the proxy group are no longer active in Yahoo Finance as of December 2021. These are indicated by "Inactive Price Series".

- Value Line and Size Adjustment are from Trial Staff Initial Br. (I), Attachment A to App. 2 at 6.
    - The following is noted for Beta, column (f):
      "See Ex. MTO-30 at 1: The Value Line Investment Survey (Mar. 22, May 1, & May 22, 2015)."

- Per the above note, 2015 Adj. Beta is calculated by averaging the Adjusted Beta in the Yahoo Finance data from 3/20/21 (the most recent Friday), 5/1/21, and 5/22/2015.

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Exhibit III: Trial Staff CAPM Data

Source: Trial Staff Initial Br. (I), Attachment A to App. 2 at 6 and author's calculations

Company	Risk-Free Rate	Risk Premium	Risk Premium - Fernandez (2015)*	Beta	Unadjusted Beta*	Size Adjustment	Implied Cost of Equity: [ROE 1]	Implied Cost of Equity w/Risk Premium - Fernandez (2015): [ROE 2]*	Implied Cost of Equity w/Unadjusted Beta: [ROE 3]*
ALLETE	0.0269	0.0912	0.055	0.8	0.7	0.0174	0.1173	0.0883	0.10814
Alliant Energy	0.0269	0.0912	0.055	0.8	0.7	0.0091	0.1090	0.08	0.09984
Ameren Corp.	0.0269	0.0912	0.055	0.75	0.625	0.0091	0.1044	0.07725	0.093
American Elec Pwr	0.0269	0.0912	0.055	0.7	0.55	-0.0036	0.0871	0.0618	0.07346
Avista Corp.	0.0269	0.0912	0.055	0.8	0.7	0.0174	0.1173	0.0883	0.10814
Black Hills Corp.	0.0269	0.0912	0.055	0.95	0.925	0.0174	0.1309	0.09655	0.12866
CenterPoint Energy, Inc.	0.0269	0.0912	0.055	0.8	0.7	0.0091	0.1090	0.08	0.09984
CMS Energy Corp.	0.0269	0.0912	0.055	0.75	0.625	0.0091	0.1044	0.07725	0.093
Consolidated Edison	0.0269	0.0912	0.055	0.6	0.4	0.0063	0.0879	0.0662	0.06968
Dominion Resources	0.0269	0.0912	0.055	0.7	0.55	-0.0036	0.0871	0.0618	0.07346
DTE Energy Co.	0.0269	0.0912	0.055	0.75	0.625	0.0063	0.1016	0.07445	0.0902
Duke Energy Corp.	0.0269	0.0912	0.055	0.6	0.400	-0.0036	0.0780	0.0563	0.05978
Edison International	0.0269	0.0912	0.055	0.75	0.625	0.0063	0.1016	0.07445	0.0902
El Paso Electric Co.	0.0269	0.0912	0.055	0.7	0.55	0.0171	0.1078	0.0825	0.09416
Empire District Electric Co.	0.0269	0.0912	0.055	0.7	0.55	0.0171	0.1078	0.0825	0.09416
Eversource Energy	0.0269	0.0912	0.055	0.75	0.625	0.0063	0.1016	0.07445	0.0902
Entergy	0.0269	0.0912	0.055	0.7	0.55	0.0063	0.0970	0.0717	0.08336
Exelon Corp.	0.0269	0.0912	0.055	0.7	0.55	-0.0036	0.0871	0.0618	0.07346
FirstEnergy Corp.	0.0269	0.0912	0.055	0.7	0.55	0.0063	0.0970	0.0717	0.08336
Great Plains Energy Inc.	0.0269	0.0912	0.055	0.85	0.775	0.0106	0.1150	0.08425	0.10818
IDACORP, Inc.	0.0269	0.0912	0.055	0.8	0.7	0.016	0.1159	0.0869	0.10674
ITC Holdings Corp	0.0269	0.0912	0.055	0.65	0.475	0.0106	0.0968	0.07325	0.08082
NextEra Energy, Inc.	0.0269	0.0912	0.055	0.75	0.625	-0.0036	0.0917	0.06455	0.0803
NorthWestern Corp.	0.0269	0.0912	0.055	0.7	0.55	0.0174	0.1081	0.0828	0.09446
OGE Energy Corp.	0.0269	0.0912	0.055	0.9	0.85	0.0091	0.1181	0.0855	0.11352
Otter Tail Corp.	0.0269	0.0912	0.055	0.9	0.85	0.0171	0.1261	0.0935	0.12152
PG&E Corp.	0.0269	0.0912	0.055	0.65	0.475	-0.0036	0.0826	0.05905	0.06662
Pinnacle West Capital	0.0269	0.0912	0.055	0.7	0.55	0.0091	0.0998	0.0745	0.08616
PNM Resources	0.0269	0.0912	0.055	0.85	0.775	0.0174	0.1218	0.09105	0.11498
Portland General Elec.	0.0269	0.0912	0.055	0.8	0.7	0.016	0.1159	0.0869	0.10674
PPL Corp.	0.0269	0.0912	0.055	0.65	0.475	0.0063	0.0925	0.06895	0.07652
Pub Service Enterprise Group Inc.	0.0269	0.0912	0.055	0.75	0.625	0.0063	0.1016	0.07445	0.0902
SCANA Corp.	0.0269	0.0912	0.055	0.75	0.625	0.0091	0.1044	0.07725	0.093
Sempra Energy	0.0269	0.0912	0.055	0.8	0.7	-0.0036	0.0963	0.0673	0.08714
Southern Company	0.0269	0.0912	0.055	0.6	0.400	-0.0036	0.0780	0.0563	0.05978
TECO Energy, Inc.	0.0269	0.0912	0.055	0.85	0.775	0.0106	0.1150	0.08425	0.10818
UIL Holdings Corp.	0.0269	0.0912	0.055	0.8	0.7	0.016	0.1159	0.0869	0.10674
Vectren Corp.	0.0269	0.0912	0.055	0.8	0.7	0.016	0.1159	0.0869	0.10674
Westar Energy, Inc.	0.0269	0.0912	0.055	0.75	0.625	0.0106	0.1059	0.07875	0.0945
Xcel Energy, Inc.	0.0269	0.0912	0.055	0.65	0.475	0.0063	0.0925	0.06895	0.07652

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MAX	0.1309	0.09655	0.12866
MIN	0.078	0.0563	0.05978
AVG	0.10445	0.076425	0.09422

*Author's calculation

Unadjusted Beta = (Beta – 1/3)*3/2

ROE 1 = Risk-Free Rate + Risk Premium*Beta + Size Adjustment

ROE 2 = Risk-Free Rate + Risk Premium – Fernandez (2015)*Beta + Size Adjustment

ROE 3 = Risk-Free Rate + Risk Premium* Unadjusted Beta + Size Adjustment

Exhibit IV: Beta & COVID-19

This exhibit further examines the precipitous increase in the sample utility betas which occurred during the onset of the COVID-19 pandemic in spring 2020. Using the data described in Exhibit II of this Appendix, this period saw an increase in the average utility beta from 0.37 on 2/21/20 to 0.88 on 4/10/20. Before proceeding, it's worthwhile to define the calculation of beta in this analysis:

$$B_Y = \frac{\mathrm{COV}(X,Y)}{\mathrm{VAR}(X)} = \frac{\sum_{i=1}^{260}(X_i - \overline{X})(Y_i - \overline{Y})}{\sum_{i=1}^{260}(X_i - \overline{X})^2}$$

where: B_Y = Beta of Utility Stock Y
COV(X,Y) = Covariance between Returns to NYSE Index (X) and Returns to Utility Stock (Y)
VAR(X) = Variance of Returns to NYSE Index
X_i = Return to NYSE Index in week "i"
Y_i = Return to Utility Stock in week "i"
Xbar = Average Return to NYSE Index
Ybar = Average Return to Utility Stock

Beta is calculated using weekly returns data over a period of five years, i.e. 260 observations on the weekly percentage change in the stock/index price. The terms (X_i – Xbar) and (Y_i – Ybar) represent the deviation of the weekly returns series to its mean over the 260-week period. The product of these terms represents the magnitude to which the NYSE Index and Utility stock returns move together and is herein referred to as the "Product of Deviation". As

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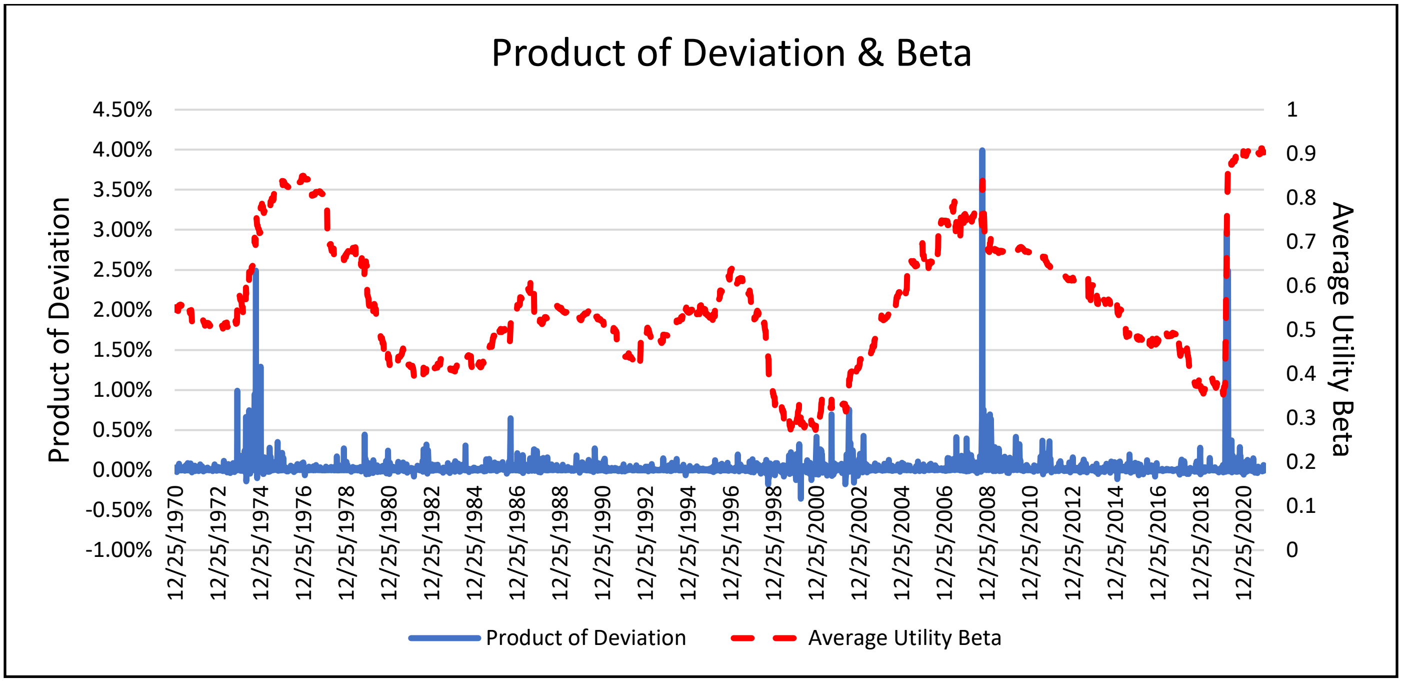
shown in the below graph, the Product of Deviation is muted over the available history except in instances of financial turmoil.



From examining the data in recent years, shown below, it's clear that the increase in beta which occurred in early 2020 was caused by five large weekly spikes in the Product of Deviation which occurred while the financial markets were experiencing turbulence during the onset of the COVID-19 pandemic. Since then, movements between utility returns and NYSE returns have subsided to normal levels. In early 2025, when the COVID-19 observations no longer factor into the calculation of beta, there should be a precipitous decline in the reported beta. It follows that the average utility beta which stood at ~0.9 as of December 2021 is not representative of the systematic risk of utility stocks which can be expected in future periods.

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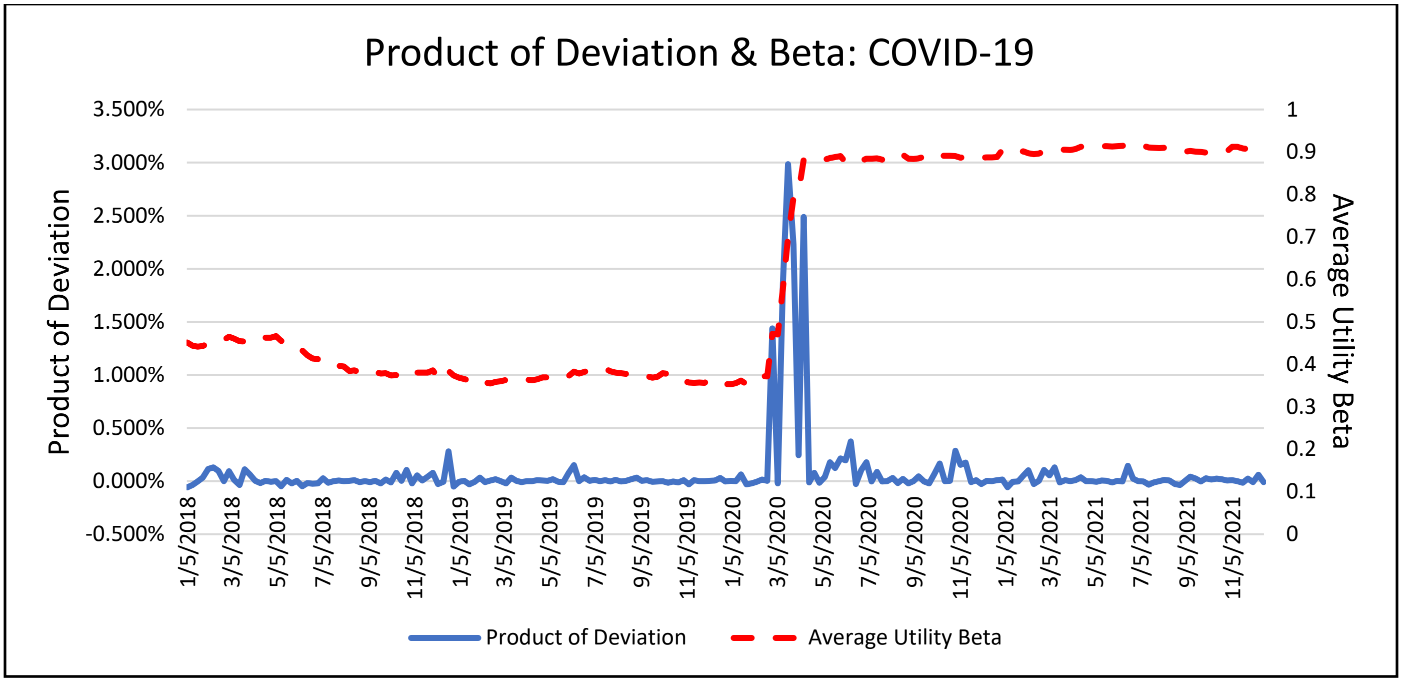

Date	Average Utility Beta	NYA Deviation	Average Utility Deviation	Product of Deviation
2/14/2020	0.37	1.08%	1.50%	0.02%
2/21/2020	0.37	-0.97%	-0.29%	0.00%
2/28/2020	**0.47**	**-11.48%**	**-12.53%**	**1.44%**
3/6/2020	0.47	-0.30%	6.79%	-0.02%
3/13/2020	**0.58**	**-12.16%**	**-15.36%**	**1.87%**
3/20/2020	**0.70**	**-15.80%**	**-18.90%**	**2.99%**
3/27/2020	**0.79**	**11.54%**	**19.31%**	**2.23%**
4/3/2020	0.81	-2.99%	-8.18%	0.24%
4/10/2020	**0.88**	**12.68%**	**19.63%**	**2.49%**
4/17/2020	0.88	0.61%	-1.97%	-0.01%
4/24/2020	0.88	-1.73%	-4.59%	0.08%

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Exhibit V: Application of Modigliani and Miller Model

$$r_e = \rho + (1 - \tau)(\rho - i)\frac{D}{E}$$

where: r_e = cost of equity
ρ = unlevered cost of equity
τ = corporate tax rate
i = current market rate of interest on debt
D/E = debt-to-equity ratio

Example 1
$\tau = 0\%$
$i = 4.65\%$

D/E Ratio	1	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
Debt %	50%	56%	60%	64%	67%	69%	71%	73%	75%
Unlevered Cost of Equity									
5.33%	6.00%	6.17%	6.34%	6.51%	6.68%	6.84%	7.01%	7.81%	7.35%
6.33%	8.00%	8.42%	8.84%	9.26%	9.68%	10.09%	10.51%	10.93%	11.35%
7.33%	10.00%	10.67%	11.34%	12.01%	12.68%	13.34%	14.01%	14.68%	15.35%
Total Cost of Capital									
	5.33%	5.33%	5.33%	5.33%	5.33%	5.33%	5.33%	5.33%	5.33%
	6.33%	6.33%	6.33%	6.33%	6.33%	6.33%	6.33%	6.33%	6.33%
	7.33%	7.33%	7.33%	7.33%	7.33%	7.33%	7.33%	7.33%	7.33%

Example 2
$\tau = 21\%$
$i = 4.65\%$

D/E Ratio	1	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
Debt %	50%	56%	60%	64%	67%	69%	71%	73%	75%
Unlevered Cost of Equity									
5.40%	6.00%	6.15%	6.30%	6.45%	6.60%	6.74%	6.89%	7.04%	7.19%
6.52%	8.00%	8.37%	8.74%	9.11%	9.48%	9.85%	10.22%	10.59%	10.69%
7.64%	10.00%	10.59%	11.18%	11.77%	12.36%	12.95%	13.54%	14.13%	14.72%
Total Cost of Capital									
	4.84%	4.77%	4.72%	4.68%	4.65%	4.62%	4.59%	4.57%	4.55%
	5.84%	5.76%	5.70%	5.65%	5.61%	5.57%	5.54%	5.52%	5.49%
	6.84%	6.75%	6.68%	6.62%	6.57%	6.53%	6.49%	6.46%	6.44%

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Example 3

$\tau = 35\%$

$i = 4.65\%$

D/E Ratio	1	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
Debt %	50%	56%	60%	64%	67%	69%	71%	73%	75%
Unlevered Cost of Equity									
5.47%	6.00%	6.13%	6.27%	6.40%	6.53%	6.66%	6.80%	6.93%	7.06%
6.68%	8.00%	8.33%	8.66%	8.99%	9.32%	9.65%	9.98%	10.31%	10.64%
7.89%	10.00%	10.53%	11.05%	11.58%	12.11%	12.63%	13.16%	13.69%	14.22%
Total Cost of Capital									
	4.51%	4.40%	4.32%	4.25%	4.19%	4.14%	4.10%	4.06%	4.03%
	5.51%	5.38%	5.28%	5.19%	5.12%	5.06%	5.01%	4.97%	4.93%
	6.51%	6.36%	6.24%	6.13%	6.05%	5.98%	5.92%	5.87%	5.82%

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Garcia and Yang 2009

Understanding Corporate Bond Spreads Using Credit Default Swaps

Alejandro Garcia and Jun Yang, Financial Markets Department

- *Since the beginning of the credit crisis, spreads on corporate bonds (the difference between the yields on a corporate bond and a government bond with identical cash flows) worldwide have widened markedly.*
- *This article decomposes Canadian corporate spreads into default and liquidity components for selected Canadian firms, using a model that extracts default information from credit default swaps.*
- *During the credit crisis in 2008, the liquidity component for speculative-grade bonds increased earlier than it did for investment-grade bonds, which is consistent with a "flight-to-quality" scenario.*
- *Although the results are based on a small sample of Canadian firms, they are consistent with recent research on how liquidity risk is priced in corporate bond markets.*

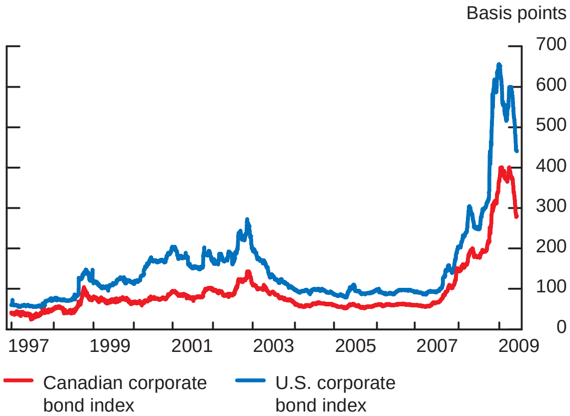
Since the beginning of the credit crisis in mid-2007, corporate spreads worldwide widened markedly. In Canada, the aggregate spread for investment-grade firms reached a maximum of 401 basis points (bps) in January and March of 2009, substantially more than the historical average of 92 bps; the spread on the equivalent index in the United States reached 656 bps in December 2008, also substantially more than its historical average of 153 bps **(Chart 1)**.[1] Owing to the problems in funding markets, corporations and financial institutions began to replace "risky" assets with "safer" ones; this "flight-to-quality" effect resulted in large price declines in equity and corporate bond markets and increases in prices in the government market.

In this article, the corporate bond spread is defined as the difference between the yields on a corporate bond and a government bond with identical cash flows. Under this definition, the corporate spread reflects the additional compensation required by investors to hold the corporate bond compared with the return on the default-free asset (the government bond). This additional yield compensates investors for two types of risk: (i) the risk of default, i.e., that the firm may not be able to meet the promised cash flows; and (ii) the liquidity risk, i.e., the risk that the investor may not be able to sell the bond quickly, before it matures, without a significant discount to the existing market price.

Since promoting financial stability is part of the mandate of central banks, they have a natural interest in understanding what drives changes in corporate spreads—default risk, liquidity risk, or both—since

1 The average spreads for Canada and the United States are calculated for the period from 31 December 1996 to 18 May 2009, using the Merrill Lynch corporate indexes for investment-grade firms. The new maximum spreads surpassed previous record highs for this period of 272 bps on 10 October 2002 for the United States and 143 bps on 24 October 2002 for Canada.

Chart 1: Corporate bond spreads in Canada and the United States



Note: Merrill Lynch spreads for broad corporate indexes. Corporate yield spreads are adjusted only for embedded options. Sample: 31 December 1996 to 18 May 2009.
Sources: Bloomberg, Merrill Lynch

their policy response will be different, depending on which factor is responsible. If, for example, rising corporate spreads result mainly from an increase in liquidity risk, and the central bank judges that this warrants intervention, then it might address the situation, at least in part, by providing liquidity. In contrast, if rising spreads are the result of increased default risk, the appropriate policy response may be quite different.[2] Decomposing corporate spreads is not easy, because both components are unobservable and possibly correlated.

This article is part of a series of papers that studies the risks—mainly default and liquidity—that are priced into corporate bond spreads.[3] Its contributions to this research agenda are as follows: (i) the use of information from the credit default swap and bond markets for Canadian firms; (ii) analysis that is performed at the firm level; and (iii) a focus on Canadian firms that access funding in the United States.[4]

Related Literature

For some time, researchers have been investigating how much of the corporate bond spread is attributable to default risk and how much stems from liquidity risk. Corporate spreads seem to be too high for default risk to be the only contributing factor; in addition, they are inconsistent with historical default rates and recoveries (Elton et al. 2001). Observed corporate spreads are also inconsistent with traditional structural models based on Merton (1974) (Huang and Huang 2003). As well, changes in spreads on corporate bonds are not well explained by changes in the factors affecting default risk (Collin-Dufresne, Goldstein, and Martin 2001), and the unexplained portion appears to have a common factor. Liquidity risk may therefore be an important factor affecting corporate spreads, since corporate bond markets are much less liquid than government bond markets. Various approaches are used in the literature to measure the two components of corporate bond spreads. These approaches are detailed next.

Liquidity component

Researchers have used different methods to measure the liquidity of corporate bonds and to study the relationship between liquidity, liquidity risk, and corporate spreads. Chen, Lesmond, and Wei (2007) use implicit bid-ask spreads and the frequency of zero returns to measure the liquidity of corporate bonds. Chacko (2005) and Mahanti et al. (2008) use the turnover of portfolios holding the bond, and others (Edwards, Harris, and Piwowar 2007; Goldstein, Hotchkiss, and Sirri 2007; Bao, Pan, and Wang 2008) use measures of the impact on prices. In general, they find a positive relationship between the illiquidity of corporate bonds and their yield spreads. Several recent studies (de Jong and Driessen 2006; Downing, Underwood, and Xing 2007; Acharya, Amihud, and Bharath 2008) analyze how liquidity risk is priced in corporate bond returns. They find that, relative to investment-grade bonds, speculative-grade bonds carry a higher liquidity-risk premium. Most of these papers estimate models focusing on one aspect of illiquidity, such as transactions costs, inventory risk, asymmetric information, or search costs. In addition, most papers relate their illiquidity measures to corporate spreads in regressions, and are therefore not suitable to decompose corporate bonds into liquidity and default components.

Default component

In general, researchers use two methods to estimate the default risk of corporate spreads. One way is to use historical default rates and recoveries; this method ignores the risk premium associated with

2 One reason why the policy reaction may be different for liquidity risk than for default risk is that the former may be the result of a "friction" (i.e., information), whereas the latter may be the result of systematic factors.
3 Garcia and Gravelle (2008) use a structural model with equity data to decompose Canadian corporate spreads.
4 Other work decomposing spreads for Canada focuses on the aggregate index spread, using equity-based structural models instead of prices on credit default swaps (see Garcia and Gravelle 2008).

default risk. Thus, in these models, no consideration is given to the extra premium that investors require to invest in risky securities whose returns are correlated with systematic factors. Another method is to determine default risk relative to other traded financial instruments, such as equity and credit derivatives. According to Merton (1974), equity can be treated as a call option on firm values. Corporate bonds can be treated as a portfolio holding an equivalent risk-free government bond and shorting a put option. Equity prices can be used to extract information about the firm's valuation process, which can then be used to price corporate bonds. The validity of this method requires that the structural models be correctly specified. Huang and Huang (2003) show, however, that since most structural models are misspecified, their results cast doubts on the value of using structural models to decompose corporate spreads.

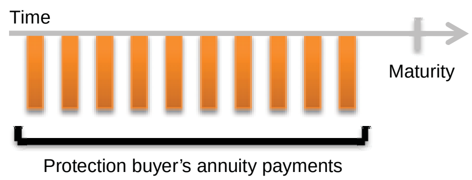
With the growth of markets for credit derivatives in recent years, researchers have started to use credit derivatives, such as credit default swaps, to estimate the default component of corporate spreads (Longstaff, Mithal, and Neis 2005). We use credit default swaps to decompose the spreads on Canadian corporate bonds because, as discussed in the next section, their lower susceptibility to liquidity effects makes them a much purer measure of default risk. In addition, the reduced-form approach we use to evaluate credit default swaps is less prone to misspecification.

Credit Default Swaps

A credit default swap (CDS) is a contract that provides insurance against the default of a particular company. The company is known as the *reference entity*, and a specific bond of the company is known as the *reference obligation*. The quantity of the reference obligation to which the derivative contract applies is known as the *notional principal*.[5] In a CDS, there are two parties to the contract: the *buyer* of credit protection makes periodic payments to the *seller* of the credit protection until either the contract matures or there is a default event by the company. In exchange for the periodic payments made by the buyer, the seller agrees to pay the buyer the difference between the face value and the market value of the reference obligation if a credit event occurs. If no default occurs, the protection buyer still makes all the agreed-upon payments. There is a payment to compensate for default losses only in the case of a default.

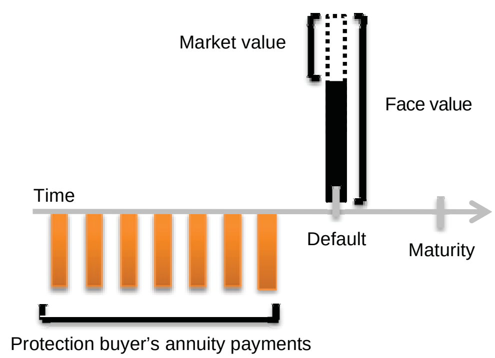
Figure 1 shows the cash flows for a typical CDS when no default occurs, while **Figure 2** shows cash flows in a default scenario. The orange boxes represent the annuity payments made by the protection buyer, while the black box in Figure 2 represents the payment that the protection seller makes to the protection buyer upon default.

Figure 1: Credit default swap: Cash flows when there is no default



Note: The orange boxes represent the payments made by the protection buyer to the protection seller.
Source: Bank of Canada

Figure 2: Credit default swap: Cash flows when default occurs



Note: The orange boxes represent the payments made by the protection buyer to the protection seller. The black box represents the payment made by the protection seller to the protection buyer at default.
Source: Bank of Canada

As in any swap, the premium (which determines the annuity payments) is the rate that equates the expected streams of cash flows that the buyer and the seller make. The CDS premium therefore contains information on the default probability associated with a reference entity, since this information is embedded in the expected payment made by the protection seller.

CDS contracts are commonly used to extract proxies for default risk for several reasons. As contracts, not securities, CDSs are far less sensitive to liquidity

5 The total outstanding notional principal of CDS contracts for a given reference entity can exceed the total amount outstanding of the reference obligation.

effects, since securities are in fixed supply, while the supply of CDSs can be arbitrarily large. Because of this reduced sensitivity, CDSs provide a better measure of default risk. As well, it is less costly for investors to liquidate CDSs prior to maturity than to liquidate a corporate bond, since investors simply enter into a swap contract in the opposite direction. Further, CDSs are not likely to become "special" like treasury bills, or "squeezed" like corporate bonds.[6] In principle, therefore, CDSs should contain mainly default information about the reference entity. However, they are not totally immune to liquidity effects, since search costs may be high for illiquid CDS contracts.[7]

In principle, CDSs should contain mainly default information about the reference entity. However, they are not totally immune to liquidity effects.

It is difficult to obtain data from the Canadian-dollar CDS market for Canadian reference entities, since this market is underdeveloped and illiquid compared with the U.S. market. Moreover, because of the illiquidity of the market, these data are likely to contain a non-negligible liquidity component, which violates our basic modelling assumption. An alternative is to use data from CDSs issued in U.S. dollars for Canadian entities. Although better than data from the Canadian-dollar CDS market, these data are available for a limited number of firms, only some of which may have liquid contracts. A caveat persists as well with respect to the degree of liquidity risk embedded in CDS prices—anecdotal evidence suggests that, during a crisis, CDS prices, like corporate bonds, might carry a liquidity-risk premium. In this study, we use the most liquid CDS contracts to decompose Canadian corporate spreads and make every effort to minimize any decomposition bias resulting from potential illiquidity in CDS contracts. In the next section, we present the data used to conduct our analysis, as well as the controls that helped to focus on the most liquid CDS contracts in our sample.[8]

Data

In practice, the CDS quote can be different from the CDS transaction price. The CDS quote reflects the risk characteristics of the reference entity, whereas the transaction price can also reflect the differential in counterparty risk between the protection buyer and the seller. For this article, we use quote data obtained from Markit Inc., the leading provider of CDS data.

We obtained a dataset of Canadian firms for which there are CDS contracts and bonds with a maturity greater than one year. Because of the aforementioned data limitations on Canadian-dollar-denominated CDSs, we use U.S.-dollar-denominated securities (CDSs and bonds). We also need data for the yields on U.S. risk-free zero-coupon bonds, which are obtained from the study by Gürkaynak, Sack, and Wright (2006). Our initial dataset included 38 Canadian firms. Filtering out Canadian Crown corporations, firms with too few CDS or corporate bond quotes, firms without senior unsecured debt, and firms for which the number of common dates between the CDS data and the corresponding bonds are less than a year, we are left with a set of eight large Canadian firms from various sectors of the economy. Six of the firms are rated BBB, while the other two are rated CC (see **Table 1** for selected statistics on the firms' bond data). The bond and CDS data used in the article cover different samples for each firm, beginning as early as June 2006 and ending as late as November 2008.[9]

For the Canadian firms selected, we prepared the data by selecting bonds and CDS prices that had two or more quotes per week and interpolating them linearly, when necessary, to obtain a common day of the week used to change the frequency of the data from daily to weekly. We did this to obtain a dataset where, at each moment in time, there is an observation for the CDS and the bond prices, which allows

6 "Specials" are specific repo rates significantly below prevailing market interest rates for loans of similar maturity and credit risk. "Squeezed" refers to a shortage of supply relative to demand for a particular security, as evidenced by a movement in its price (or its repo rate) to a level that is not in line with the prices of comparable securities.

7 Longstaff, Mithal, and Neis (2005) use the most liquid CDS contracts in their study.

8 Note that default risk on Canadian-dollar and U.S.-dollar bonds issued by the same Canadian entity may differ, to the extent that they could be subject to different rules governing default or debt workouts in different jurisdictions.

9 The sample data available for the eight firms used here are for the following periods: Firm 1, 30 June 2006–14 November 2008; Firm 2, 23 June 2006–31 October 2008; Firm 3, 8 June 2007–24 October 2008; Firm 4, 22 June 2007–31 October 2008; Firm 5, 14 July 2006–7 November 2008; Firm 6, 30 June 2006–7 November 2008; Firm 7, 10 November 2006–14 November 2008; and Firm 8, 30 June 2006–31 October 2008.

Table 1: Firms' bond data

Rating	BBB	CC
Number of firms	6	2
Minimum number of bonds	2	3
Maximum number of bonds	3	4

Note: Data from Markit Inc. cover the period June 2006 to November 2008. The BBB rating includes all ranges within the BBB category. CC-rated firms were downgraded to D in April 2009.
Source: Markit Inc.

the model to extract information simultaneously from all prices and thus to decompose the spread.

Table 2 provides descriptive statistics for each CDS contract. The CDS premiums show that the eight firms in our sample can be separated into two groups: sub-investment (or speculative-) grade firms, which includes Firms 1 and 2; and investment-grade firms. Firms in the first group have higher and more volatile CDS premiums, while those in the second group have lower and more stable premiums.

Table 2: Contract data for credit default swaps

	Premiums on credit default swaps (in basis points)			
	Mean	Standard deviation	Maximum	Rating
Firm 1	1,665	1,612	6,984	Speculative
Firm 2	1,082	967	5,995	Speculative
Firm 3	87	64	405	Investment
Firm 4	350	90	538	Investment
Firm 5	108	50	213	Investment
Firm 6	141	57	306	Investment
Firm 7	75	66	337	Investment
Firm 8	71	69	403	Investment

Note: All CDS contracts have a 5-year maturity.
Source: Bank of Canada

Methodology

We use a reduced-form model based on the framework of Jarrow and Turnbull (1995); Lando (1998); and Duffie and Singleton (1999). In this model, investors demand a return for holding corporate bonds that includes the risk-free rate, the default risk of the issuer, and the liquidity premium associated with the security. Similarly, investors demand compensation for selling the CDS that includes the risk-free rate and the default risk associated with the reference entity (bond issuer). Note that, in the model, we assume that the bond yield includes compensation for liquidity and default risk, whereas the CDS includes compensation only for default risk.[10]

The methodology can be summarized as follows. We have two unobserved variables, liquidity and default, as well as time series for the CDSs and several bond prices for the same reference entity. From the CDSs, we obtain the default factor, which is used to obtain the liquidity factor from the bond prices. We are able to determine both factors by estimating the parameters of the model to minimize pricing errors.[11] We proceed to create a synthetic zero-coupon 5-year bond. For the synthetic bond, we find the corresponding yield to maturity and subtract the risk-free rate to obtain the corporate spread. The corporate spread thus obtained is then decomposed into its default component, such that the yield to maturity includes only the risk-free rate and the default compensation, and its liquidity component (the difference between the corporate spread and the default component).

Results

We first analyze the results around three key events: (i) the Bear Stearns liquidation of two hedge funds that invested in various types of mortgage-backed securities on 31 July 2007; (ii) the announcement by the Federal Reserve Bank of New York that it would provide term financing to facilitate the acquisition by JPMorgan Chase of The Bear Stearns Companies on 24 March 2008; and (iii) Lehman Brothers filing for Chapter 11 bankruptcy protection on 15 September 2008.[12] **Chart 2** shows the decomposition for the average firm from the investment-grade category, and **Chart 3** shows the results for the average firm from the speculative-grade category.

The liquidity component of both investment- and speculative-grade firms started to increase right after the liquidation of the Bear Stearns hedge funds, consistent with the overall market conditions. After the acquisition of Bear Stearns, the investment-grade firms' liquidity and default component decreased slightly, and the speculative-grade firms' components also decreased for a short period. Both of these effects possibly reflect the awareness of government support for troubled firms. After the filing by Lehman,

10 This assumes that the CDS liquidity compensation is negligible.
11 See the **Box** on p. 28 and Longstaff, Mithal, and Neis (2005) for details on the model and the estimation.
12 Another key event was the halt on redemptions on three investment funds on 9 August 2007 by BNP Paribas, France's largest bank. This, with the Bear Stearns acquisition, triggered subsequent events that led to the financial crisis.

Estimating the Model

Let r_t denote the risk-free rate, λ_t the intensity of the Poisson process governing default, γ_t a liquidity premium, and c the continuous coupon rate paid by the corporate bond. Each of the processes r_t, λ_t, and γ_t is stochastic. Following Lando (1998), we assume that a bondholder recovers a fraction $1-w$ (fixed at 50 per cent) of the par value of the bond in the event of default. Then a corporate bond that pays a continuous coupon rate c is priced as follows:

$$
\begin{aligned}
P_{bond} &= E^Q\left[c\int_0^T e^{-\int_0^t (r_s+\lambda_s+\gamma_s)\,ds}\,dt\right] \\
&+ E^Q\left[\int_0^T e^{-\int_0^t (r_s+\lambda_s+\gamma_s)\,ds}\,dt\right] \\
&+ (1-w)E^Q\left[\int_0^T \lambda_t e^{-\int_0^t (r_s+\lambda_s+\gamma_s)\,ds}\,dt\right],
\end{aligned}
\qquad (1)
$$

where T is the time to maturity. Let s denote the continuous premium paid by the CDS buyer. The present value of the premium leg of a credit default swap *(Pre)* can be expressed as,

$$
Pre = E^Q\left[s\int_0^T e^{-\int_0^t (r_s+\lambda_t)\,ds}\,dt\right]. \qquad (2)
$$

The value of the protection leg of a CDS *(Pro)* can be expressed as:

$$
Pro = E^Q\left[w\int_0^T \lambda_t e^{-\int_0^t (r_s+\lambda_t)\,ds}\,dt\right]. \qquad (3)
$$

From equating both payment legs, we obtain the expression for the CDS premium as:

$$
s = \frac{E^Q\left[w\int_0^T \lambda_t e^{-\int_0^t (r_s+\lambda_t)\,ds}\,dt\right]}{E^Q\left[\int_0^T e^{-\int_0^t (r_s+\lambda_t)\,ds}\,dt\right]}. \qquad (4)
$$

To obtain closed-form evaluations for both corporate bonds and CDSs, we specify the risk-neutral dynamics for default-intensity process λ_t and liquidity process γ_t as follows:

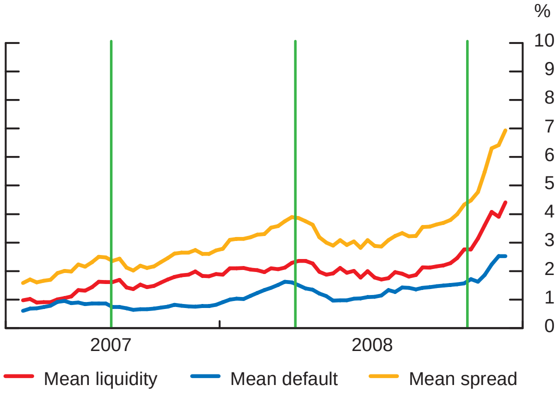
$$
\begin{aligned}
d\lambda_t &= (\alpha - \beta\lambda)dt + \sigma\sqrt{\lambda}\,dZ_t \\
d\gamma &= \eta\, dZ_t.
\end{aligned}
\qquad (5)
$$

The closed-form formula for both corporate bonds and CDS premiums can be found in Longstaff, Mithal, and Neis (2005). To estimate the model, we minimize the pricing error for the CDS premiums and the bond prices associated with a given firm. We recover λ_t from time-series observations of CDS premiums;[1] then, at each time t, we recover γ_t by minimizing the percentage pricing errors from at least two corporate bonds at time t. We find maximum-likelihood estimates for those parameters by minimizing the sum of corporate bond pricing errors over the entire sample.

1 The initial values used for the parameters are reasonable estimates, based on the literature and recent evidence.

Chart 2: Corporate bond spreads for an average investment-grade firm

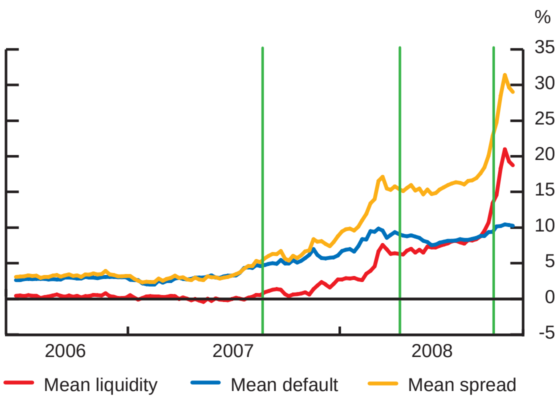
Synthetic zero-coupon 5-year bond



Note: The green lines represent the dates when Bear Stearns liquidated two hedge funds that had invested in mortgage-backed securities (31 July 2007), the Federal Reserve Bank of New York announced that it would provide term financing to facilitate JPMorgan Chase's acquisition of Bear Stearns (24 March 2008), and Lehman Brothers filed for Chapter 11 bankruptcy (15 September 2008).
Source: Bank of Canada estimates

Chart 3: Corporate bond spreads for an average speculative-grade firm

Synthetic zero-coupon 5-year bond



Note: The green lines represent the dates when Bearn Stearns liquidated two hedge funds that had invested in mortgage-backed securities (31 July 2007), the Federal Reserve Bank of New York announced that it would provide term financing to facilitate JPMorgan Chase's acquisition of Bear Stearns (24 March 2008), and Lehman Brothers filed for Chapter 11 bankruptcy (15 September 2008).
Source: Bank of Canada estimates

the default component of the average investment- and speculative-grade firm started to increase, while the liquidity component for both increased substantially. It is difficult to determine the medium-term impact of the filing by Lehman, since there are only a limited number of days for which the CDS data for Canadian firms are still reliable. After September 2008, the CDS data quickly become unreliable as a pure source of default risk, owing to reduced trading—or no trading at all—in the market. Right after the filing by Lehman, however, we notice that, for both types of firm, it is the increase in the liquidity component that dominates the change in the spread. This is in line with the drastic deterioration in North American credit markets.

In more general terms, our results show that, for investment-grade firms, the majority of the spread corresponds to liquidity; on average, the liquidity component accounts for 63 per cent of the spread. For speculative-grade firms, it is the reverse—the majority of the spread corresponds to default, with the default component accounting for 77 per cent of the spread, on average.[13] In addition, our results provide evidence that the liquidity component increased earlier for the speculative-grade firms.

For investment-grade firms, the majority of the spread corresponds to liquidity. For speculative-grade firms, the majority of the spread corresponds to default.

These results are consistent with those of de Jong and Driessen (2006) and Acharya, Amihud, and Bharath (2008) in finding that the credit crisis has had a larger impact on speculative-grade than on investment-grade bonds. As shown in Charts 2 and 3, the overall spread is much higher and the liquidity component (red line) increased markedly and earlier for speculative-grade firms.[14] For the average investment-grade firm, the increase in the liquidity component was less drastic than the corresponding increase for the average speculative-grade firm, at least prior to the Lehman filing, after which it dominates the change in the spread. At this point, however, the CDS data are a less-reliable source of default risk.

Similarly, a comparison of the volatility of the liquidity component across firms shows that spreads for (speculative-grade) firms 1 and 2 exhibited larger volatilities in their liquidity component than did (investment-grade) firms 3 to 8 **(Table 3)**. Although firm 7 has a mean liquidity component higher than that of firm 2, the associated standard deviation is much smaller.

13 For speculative-grade bonds, the liquidity premium is a smaller share of a wider spread, and thus is larger in absolute terms.
14 Note that the vertical axis in Chart 3 is more than three times larger than the one in Chart 2.

Table 3: Volatility of the liquidity component (%)

	Mean	Standard deviation	Rating
Firm 1	4.13	5.74	Speculative
Firm 2	2.14	3.85	Speculative
Firm 3	1.58	0.37	Investment
Firm 4	1.57	1.04	Investment
Firm 5	1.39	0.74	Investment
Firm 6	1.98	1.12	Investment
Firm 7	3.00	0.63	Investment
Firm 8	0.93	0.98	Investment

Note: The level of the liquidity component is obtained from the total spread minus the spread with only default taken into account.
Source: Bank of Canada

Conclusion

In this article, we used a reduced-form credit-risk model to decompose the spread for Canadian firms that issue bonds in the U.S. market. Our main results suggest that the proportion of liquidity and default risk varies across firms and over time, and that the nature of the variation depends on the nature of the shock to the economy. More-specific results that apply to the credit crisis of 2007–08 are: (i) the relative size of the liquidity component in corporate bond spreads is larger for investment-grade bonds than for speculative-grade bonds; (ii) both the liquidity and default components of corporate spreads for speculative-grade bonds increased markedly after the beginning of the crisis; and (iii) the liquidity component increased more for speculative-grade bonds during the credit crisis, which is typical of a "flight-to-quality" phenomenon. While these findings are consistent with intuition, they should be verified with a larger sample of firms once more data become available as the market for CDSs for Canadian firms develops further.

The proportion of liquidity and default risk varies across firms and over time, and the nature of the variation depends on the nature of the shock to the economy.

A key implication of these results is that, in designing policies to address problems in credit markets, it is important to consider that the liquidity component in corporate spreads for investment- and speculative-grade bonds behaves differently than the default risk, especially during crisis episodes.

Future work on the decomposition of corporate bond spreads should focus on: (i) the study of Canadian-dollar-denominated corporate bond markets, (ii) comparing different methods of decomposing Canadian corporate spreads, and (iii) incorporating time-varying default- and liquidity-risk premiums in the analysis. In addition, appropriate policy responses under different conditions should be investigated.

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BYPRP Example – CFA Curriculum

The default risk premium captures factors such as profitability, the sensitivity of profitability to the business cycle, and leverage (operating and financial) that also affect the returns to equity. The risk premium in Equation 13 is the premium that compensates for the additional risk of the equity issue compared with the debt issue (recognizing that debt has a prior claim on the cash flows of the company). In US markets, the typical risk premium added is 3–4 percent, based on experience.

EXAMPLE 9 The Cost of Equity of IBM from Two Perspectives

You are valuing the stock of International Business Machines Corporation (NYSE: IBM) as of early August 2013, and you have gathered the following information:

30-year T-bond YTM:	3.70%
IBM 4s of 2042 YTM:	4.43%

The IBM bonds, you note, are investment grade (rated AA– by Standard & Poor's, Aa3 by Moody's Investors Service, and A+ by Fitch). The beta on IBM stock is 0.73. In prior valuations you have used a risk premium of 3 percent in the bond yield plus risk premium approach. However, the estimated beta of IBM has decreased over the past five years. As a matter of judgment, you have decided as a consequence to use a risk premium of 2.75 percent in the bond yield plus risk premium approach.

1. Calculate the cost of equity using the CAPM. Assume that the equity risk premium is 4.20 percent.
2. Calculate the cost of equity using the bond yield plus risk premium approach, with a risk premium of 2.75 percent.
3. Suppose you found that IBM stock, which closed at $195.04 on 31 July 2013, was slightly undervalued based on a DCF valuation using the CAPM cost of equity from Question 1. Does the alternative estimate of the cost of equity from Question 2 support the conclusion based on Question 1?

Solution to 1: 3.70% + 0.73(4.20%) = 6.77%.

Solution to 2: Add 2.75 percent to the IBM bond YTM: 4.43% + 2.75% = 7.18%. Note that the difference between the IBM bond YTM and T-bond YTM is 0.73 percent, or 73 basis points. This amount plus 2.75 percent is the total estimated risk premium versus Treasury debt, 0.73% + 2.75% = 3.48%.

Solution to 3: Not necessarily; *undervalued* means that the value of a security is greater than market price. All else being equal, the lower the discount rate, the higher the estimate of value. The inverse relationship between discount rate and value, holding all else constant, is a basic relationship in valuation. If IBM appears to be undervalued using the CAPM cost of equity estimate of 6.77 percent, that does not necessarily mean it will also appear to be undervalued using a 7.18 percent cost of equity based on the bond yield plus risk premium method.

Table 3 Data: Real GDP Growth Forecasts – Canada (2024-2026)

Table 4 Data: CPI Forecasts – Canada (2024-2026)

Table 5 Data: 10-Year Yield Forecasts – Canada

BANK OF CANADA
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Monetary Policy Report

April 2024

Canada's inflation-control strategy

Inflation targeting and the economy

- The objective of Canada's monetary policy is to promote the economic and financial well-being of Canadians. Canada's experience with inflation targeting since 1991 has shown that the best way that monetary policy can achieve this goal is by maintaining a low and stable inflation environment. Doing so fosters confidence in the value of money and contributes to sustained economic growth, a strong and inclusive labour market and improved living standards.
- In 2021, the Government of Canada and the Bank of Canada renewed the flexible inflation-targeting strategy of the monetary policy framework for a further five-year period, ending December 31, 2026.[1]
- The inflation target was renewed at the 2% midpoint of the 1%–3% control range, with inflation measured as the 12-month rate of change in the consumer price index (CPI).
- The Government and the Bank agreed that the best contribution monetary policy can make to the economic and financial well-being of Canadians is to continue to focus on price stability. The Government and the Bank also agreed that monetary policy should continue to support maximum sustainable employment, recognizing that maximum sustainable employment is not directly measurable and is determined largely by non-monetary factors that can change through time.
- Further, the Government and the Bank agreed that because well-anchored inflation expectations are critical to achieving both price stability and maximum sustainable employment, the primary objective of monetary policy is to maintain low, stable inflation over time.

Inflation targeting is *symmetric* and *flexible*

- Canada's inflation-targeting approach is *symmetric*, which means the Bank is equally concerned about inflation rising above or falling below the 2% target.
- Canada's inflation-targeting approach is also *flexible*. Typically, the Bank seeks to return inflation to target over a horizon of six to eight quarters. However, the most appropriate horizon for returning inflation to target will vary depending on the nature and persistence of the shocks buffeting the economy.
- The 2021 agreement with the Government specifies that the 2% inflation target remains the cornerstone of the framework.
- The agreement further notes that the Bank will continue to use the flexibility of the 1%–3% control range to actively seek the maximum sustainable level of employment, when conditions warrant. The Bank will also continue to leverage the flexibility inherent in the framework to help address the challenges of structurally low interest rates by using a broad set of policy tools. The Bank will use this flexibility only to an extent that is consistent with keeping medium-term inflation expectations well anchored at 2%.

Monetary policy tools

- Because monetary policy actions take time to work their way through the economy and have their full effect on inflation, monetary policy must be forward-looking.
- The Bank normally carries out monetary policy through changes in the target for the overnight rate of interest (the policy rate). The Bank also has a range of monetary policy tools it can use when the policy rate is at very low levels. These tools consist of guidance on the future evolution of the policy rate, large-scale asset purchases (quantitative easing and credit easing), funding for credit measures, and negative policy rates. The potential use and sequencing of these tools would depend on the economic and financial market context.
- All of the Bank's monetary policy tools affect total demand for Canadian goods and services through their influence on market interest rates, domestic asset prices and the exchange rate. The balance between this demand and the economy's production capacity is, over time, the main factor that determines inflation pressures in the economy.

Communications

- Consistent with its commitment to clear, transparent communications, the Bank regularly reports its perspectives on the economy and inflation. Policy decisions are typically announced on eight pre-set days during the year with a press release followed by a press conference, and full updates to the Bank's outlook are published four times each year in the *Monetary Policy Report*.
- The Bank is committed to explaining when it is using the flexibility of the inflation-targeting strategy.
- Given the uncertainty about the maximum sustainable level of employment, the Bank will consider a broad range of labour market indicators. The Bank will also systematically report to Canadians on how labour market outcomes have factored into its policy decisions.

Monitoring inflation

- In the short run, the prices of certain CPI components can be particularly volatile and can cause sizable fluctuations in CPI inflation.
- In setting monetary policy, the Bank seeks to look through such transitory movements in CPI inflation and focuses on "core" inflation measures that better reflect the underlying trend of inflation. In this sense, these measures act as an operational guide to help the Bank achieve the CPI inflation target. They are not a replacement for CPI inflation.
- The Bank's two preferred measures of core inflation are CPI-trim, which excludes CPI components whose rates of change in a given month are the most extreme, and CPI-median, which corresponds to the price change located at the 50th percentile (in terms of basket weight) of the distribution of price changes.

1 For more details, see *Joint Statement of the Government of Canada and the Bank of Canada on the Renewal of the Monetary Policy Framework* (December 13, 2021); *Monetary Policy Framework Renewal—December 2021;* and T. Macklem, "Our Monetary Policy Framework: Continuity, Clarity and Commitment" (speech to the Empire Club of Canada, Toronto, December 15, 2021).

The *Monetary Policy Report* is available on the Bank of Canada's website at bankofcanada.ca.

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BANK OF CANADA
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Monetary Policy Report

April 2024

This is a report of the Governing Council of the Bank of Canada:
Tiff Macklem, Carolyn Rogers, Toni Gravelle, Sharon Kozicki, Nicolas Vincent and Rhys Mendes

Contents

Overview

Consumer price index (CPI) inflation in Canada is easing as monetary policy works to reduce inflationary pressures. Core inflation is also coming down, although risks remain and it will take more time to see if this progress proves durable.

The global economy is expected to grow at around 3% this year and next. In the United States, economic growth has been surprisingly resilient. A strong job market is boosting consumer spending, and business investment is up due to increasing demand and government incentives. US growth is expected to slow later this year but to remain stronger than previously projected.

Inflation is easing in most advanced economies and is expected to return to central bank targets in 2025.

After stalling in the second half of 2023, economic growth in Canada has picked up. This largely reflects both strong population growth, which adds to the supply of workers, and a recovery in household spending. Labour market conditions continue to ease, and there is some evidence that wage growth has begun to moderate. Businesses are not raising prices as frequently, and inflation expectations are coming down slowly.

Canada's economy is expected to strengthen in 2024 but to remain in excess supply. Excess capacity starts to diminish in 2025 as demand growth remains solid and supply growth moderates.

There has been progress on most indicators of underlying inflation. Recent downward momentum in core inflation, if sustained, will pull inflation down further, but higher gasoline prices are expected to keep CPI inflation close to 3% into the second quarter of 2024. Inflation then eases below 2.5% in the second half of the year and returns to target near the end of 2025.

Global economy

Inflation continues to move lower in most advanced economies but is still above central bank targets. Further easing in inflation is expected to be gradual because inflation in services prices remains high.

Global growth is expected to remain at around 3% over the projection horizon. The outlook for global growth is revised up from the January Report (**Box 1**). The surprising strength of the US economy accounts for a substantial portion of the increase (**Table 1**).

Table 1: Projection for global economic growth

	Share of real global GDP* (%)	Projected growth† (%)			
		2023	2024	2025	2026
United States	16	2.5 (2.5)	2.7 (1.7)	1.8 (1.2)	2.2
Euro area	12	0.5 (0.4)	0.4 (0.5)	1.2 (1.6)	1.7
Japan	4	1.9 (2.0)	0.8 (0.7)	0.7 (1.1)	0.5
China	18	5.2 (5.2)	4.7 (4.5)	4.4 (4.5)	3.9
Oil-importing EMEs‡	34	3.9 (3.7)	3.5 (3.1)	3.7 (3.6)	4.0
Rest of the world§	16	1.2 (1.2)	1.7 (1.5)	2.7 (1.5)	2.5
World	100	3.1 (3.0)	2.8 (2.5)	3.0 (2.7)	3.1

* Shares of gross domestic product (GDP) are based on International Monetary Fund (IMF) estimates of the purchasing-power-parity valuation of country GDPs for 2022 from the IMF's October 2023 *World Economic Outlook*. The individual shares may not add up to 100 due to rounding.

† Numbers in parentheses are projections used in the previous Report.

‡ The oil-importing emerging-market economies (EMEs) grouping excludes China. It is composed of large EMEs from Asia, Latin America, the Middle East, Europe and Africa (such as India, Brazil and South Africa) as well as newly industrialized economies (such as South Korea).

§ "Rest of the world" is a grouping of other economies not included in the first five regions. It is composed of oil-exporting EMEs (such as Russia, Nigeria and Saudi Arabia) and other advanced economies (such as Canada, the United Kingdom and Australia).

Sources: National sources via Haver Analytics, and Bank of Canada calculations and projections

Box 1

Changes to the economic projection since the January Report

Global outlook

The outlook for global growth is stronger over the projection than in the January Report.

Growth in US gross domestic product (GDP) has been revised up significantly. The upward revision is due to a broad-based increase in the outlook for near-term growth in domestic demand. It is also because the rate of immigration into the United States has been higher than expected. Over the projection, the stronger rate of immigration contributes to a more rapid increase in the supply of labour, which boosts both potential output and demand growth in the United States (see the **Appendix**, page 26).

Factors that support the upward revision in the demand outlook over the near term include:

- stronger growth in labour income, supported by more-persistent gains in employment and higher wage growth than previously anticipated
- easier-than-expected financial conditions
- a larger and more persistent response to investment incentives from the federal government

Overall, US growth is expected to be 1.0 percentage point higher in 2024 and 0.6 percentage points higher in 2025 than in the January Report.

Growth in both the emerging-market economies and rest-of-the-world groupings has been revised up. The upward revisions reflect:

- more resilient economic activity in the near term and easier-than-expected financial conditions in emerging-market economies
- a stronger outlook for potential output growth, partly led by a more robust investment outlook in both regions

Together, these revisions leave global output growth 0.3 percentage points higher in both 2024 and 2025.

Canadian outlook

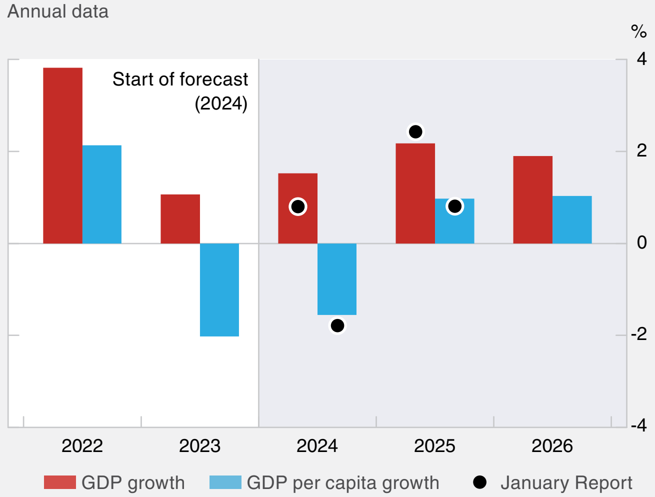
The outlook for growth in Canada has been revised up, and inflationary pressures have been easing somewhat faster than anticipated in the January Report.

- An upward revision to population leads to higher GDP and higher potential output. Canada's population growth is revised up for both 2023 and 2024 because of the larger-than-expected number of non-permanent residents arriving in the country. Population growth in 2025 has been revised down significantly, reflecting the government's recently announced plan to limit the number of temporary residents in Canada.
- Potential output growth has been revised up by 0.4 percentage points in 2024 and down by 0.3 percentage points in 2025. Overall, the level of potential output is roughly unchanged by the end of 2025. Details on the Bank of Canada's assessment of potential output growth are provided in the **Appendix**.
- The outlook for GDP growth is revised up in 2024 and is broadly unchanged in 2025. **Table 2** and **Table 3** show the revisions to the forecast. The upward revision is mainly due to stronger population growth. Growth in GDP per capita is similar to that in the January Report (**Chart 1-A**).
  - Growth in consumption spending is stronger over the near term largely because of higher population growth.
  - Export growth is revised up because of stronger foreign demand.
  - Economic activity is supported by new fiscal measures announced in recent provincial budgets.

(*continued...*)

Chart 1-A: Growth in GDP per capita is broadly unchanged since January

Annual data



Sources: Statistics Canada and Bank of Canada calculations, estimates and projections

Box 1 (*continued*)

The outlook for consumer price index (CPI) inflation has been revised down by 0.2 percentage points in 2024 and is roughly unchanged in 2025.

- Despite a partial offset from higher energy prices, CPI inflation has come in lower than expected in the January Report.
- Inflation in goods excluding food and energy has been lower than expected. Growth in input costs has weakened further, and this is being passed through to consumer prices.
- Inflation in CPI components such as communications has been lower than expected, and some of this softness is anticipated to persist over the near term.

Strong US growth

Economic growth in the United States has slowed due to the effect of past increases in interest rates. Nonetheless, GDP growth remains robust—it is expected to average 2½% in the first half of 2024, reflecting several tailwinds:

- Consumption spending is supported by strong gains in real income resulting from solid growth in wages and employment. Rising financial wealth has bolstered spending. At the same time, low-income households have increasingly been relying on revolving credit.
- Business investment is boosted by strong consumer demand as well as federal government incentives in the *Inflation Reduction Act* and the *CHIPS and Science Act*.
- Government spending is robust, particularly at the state and local levels, where it is closely tied to tax revenues. Strong federal government spending is widening the budget deficit.

Growth is projected to experience a modest slowdown to 1½% in the second half of 2024 as some of these tailwinds dissipate. Consumption growth is anticipated to slow, largely because labour income growth has moderated from last year's rapid pace, and households' credit limits are expected to become more binding. In addition, the pace of spending on investment by businesses is expected to ease due to the fading effect of government incentives and slowing consumer demand.

Growth in the US economy is then anticipated to increase toward the middle of 2025 and rise to about 2¼% in 2026 as growth in consumption strengthens in response to lower interest rates.

US growth is projected to be significantly stronger than in the January Report—primarily due to an increase in potential output (see **Box 1,** page 3, and the **Appendix**, page 26). Overall, by the end of 2025, the level of GDP in the United States is expected to be around 1¾% higher than estimated in the January Report.

Slowing US inflation

Inflation in the United States has continued to slow, with growth in the personal consumption expenditures (PCE) price index reaching 2.5% in February—down from its mid-2022 peak of 7.1% (**Chart 1**).[1] Over recent months, easing inflation in the prices of non-energy goods and services has been the main driver of the decline in total inflation.

Slowing inflation in core goods prices reflects both demand and supply factors. Past increases in interest rates and a gradual shift in spending patterns back toward in-person services have slowed demand. At the same time, supply disruptions from the COVID-19 pandemic have been resolved.

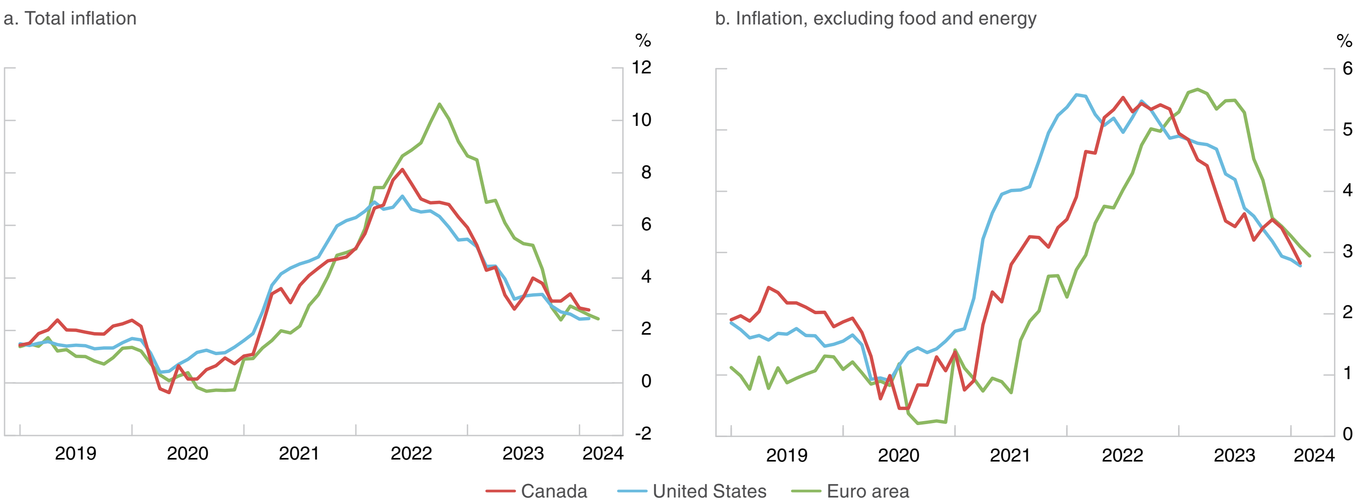
However, inflation in core services remains elevated at 3.9% despite a gradual easing in recent months. While growth in rental prices for new tenants has slowed, it will take time for that improvement to feed through to shelter services price inflation. In addition, cost pressures in other services are decreasing slowly. Wage inflation remains elevated, while productivity growth in the services sector has been flat.

Further slowing in US inflation is expected to be uneven. Inflation in energy prices is picking up and is expected to temporarily boost total inflation in the coming months. In addition, the effect of past supply disruptions, which has pulled down inflation in goods prices, has largely run its course. As a result, future easing in inflation will likely be driven by the evolution of services prices. Three-month measures of inflation also reinforce the idea that there will be bumps in the road. The three-month inflation rate in the core PCE price index is currently around 3½%, above its annual pace of 2.8%.

Inflation is projected to reach the US Federal Reserve's target in 2025.

Chart 1: Inflation is slowing

Year-over-year percentage change, monthly data



Note: Inflation rate calculations are based on the Harmonised Index of Consumer Prices for the euro area, the personal consumption expenditures price index for the United States and the consumer price index for Canada.

Sources: Statistics Canada, US Bureau of Economic Analysis and Eurostat via Haver Analytics, and Bank of Canada calculations

Last observations: Euro area, March 2024; others, February 2024

1 CPI inflation in the United States is elevated at 3.2%. Inflation in the US CPI is currently higher than inflation in the US PCE price index. This is because shelter price inflation carries a bigger weight in the CPI measure than in the PCE measure, and shelter price inflation in the United States is relatively strong. The US CPI measure is constructed in a similar way to Canada's CPI. The US Federal Reserve's inflation target is for 2% inflation in the PCE price index.

Weak euro area growth

Growth in the euro area remains weak. Past increases in interest rates, along with tight credit conditions and subdued economic sentiment, have weighed on demand. In addition, export growth has been soft because of weakness in some key trading partners and challenges with international competitiveness.

Growth in the euro area is anticipated to pick up gradually toward the middle of 2024. Lower inflation and improving economic sentiment are expected to contribute to the strengthening economic outlook. Lower interest rates support a further pickup in growth in the latter part of the projection.

Inflation in the euro area has continued to slow, reaching 2.4% in March. The decline has largely reflected easing inflation in energy and, more recently, food prices. In addition, inflation in core goods prices has fallen. The impact of the supply bottlenecks and the energy shocks associated with Russia's invasion of Ukraine have eased. Past increases in interest rates and subdued economic confidence are also weighing on demand and feeding through to lower inflation.

Going forward, euro area inflation is expected to moderate further, although at a more gradual pace. As the labour market moves into better balance and wage growth slows, services prices—which become the main driver of inflation in the future—are expected to ease only slowly. Inflation is projected to reach the European Central Bank's 2% target in 2025.

Headwinds to activity in China

Economic activity in China has been restrained by ongoing deleveraging in China's property sector, which is weighing on consumer confidence. In addition, businesses in some sectors face an uncertain regulatory environment. However, fiscal and monetary policies are expected to provide a temporary boost to growth. Falling export prices are also helping to lift exports.

Growth is projected to slow from more than 5% in the past year to near 4% in the latter part of the projection. Growth in business investment is expected to weaken, partly in response to a shrinking workforce and continued weakness in the property sector. High levels of public debt are expected to increasingly constrain growth in public spending.

Financial conditions eased

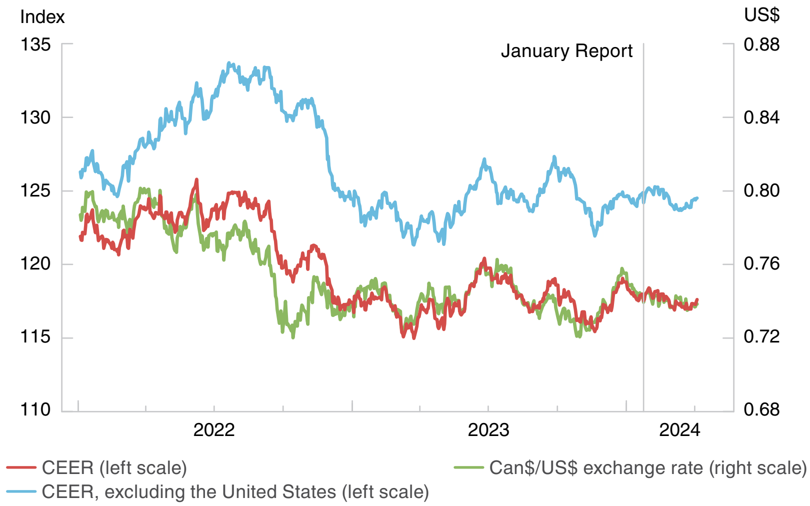
Global financial conditions have eased since the January Report as the economic outlook has improved. Risk premiums have fallen, and equity prices have risen as markets have perceived the risks of a recession to have lessened.

This easing in financial conditions has occurred even though markets expect fewer US policy rate cuts in 2024 and government bond yields have increased.

These developments have also occurred in Canada, leading to an easing in domestic financial conditions. The Canadian dollar is roughly unchanged since the January Report (**Chart 2**).

Chart 2: The value of the Canadian dollar is largely unchanged from the January Report

Canadian exchange rates, daily data



Note: CEER is the Canadian Effective Exchange Rate index—a weighted average of bilateral exchange rates for the Canadian dollar against the currencies of Canada's major trading partners.

Sources: Bloomberg Finance L.P. and Bank of Canada calculations

Last observation: April 4, 2024

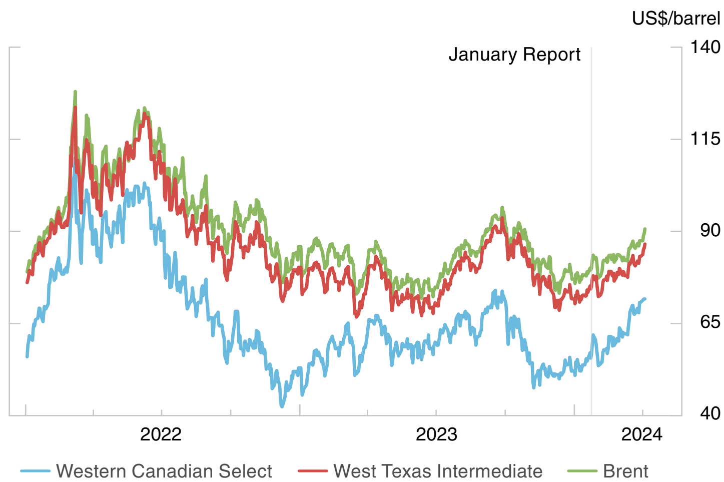
Increased oil prices

Brent oil is trading above the US$80 price assumed in the January Report (**Chart 3**). Two main factors have supported oil prices in recent months:

- Members of the Organization of the Petroleum Exporting Countries (OPEC) and some non-OPEC oil producers announced their intention to extend their voluntary production cuts through at least the middle of 2024.
- The ongoing conflict in the Middle East and Russia's war on Ukraine, along with the rerouting of tankers away from the Red Sea, have all contributed to a persistent risk premium on oil prices.

Chart 3: Oil prices have increased since the January Report

Daily data



Sources: Kalibrate Canada Inc., NYMEX and Intercontinental Exchange via Haver Analytics

Last observation: April 4, 2024

As a result, the per-barrel price of Brent oil has averaged around $85 since the January Report and is assumed to be at this level over the projection horizon (**Box 2**).

Box 2

Key inputs to the projection

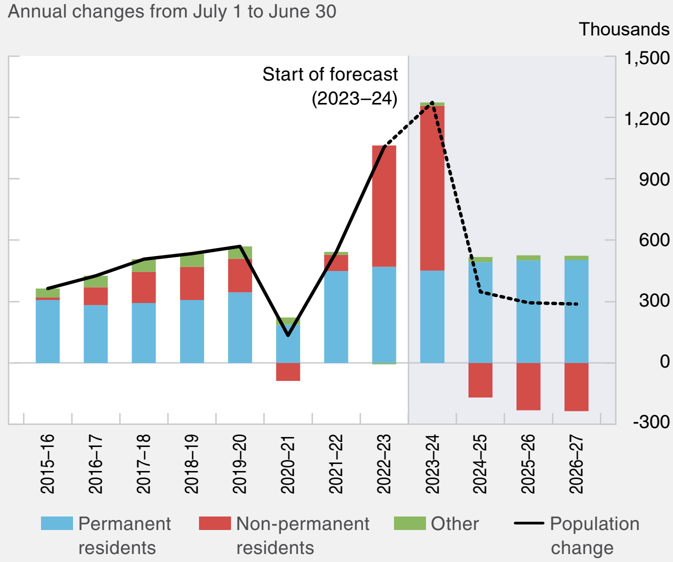
The Bank of Canada's projection is conditional on several key inputs and assumptions about their future path. The Bank regularly reviews these assumptions and adjusts the economic projection accordingly. The key inputs to the Bank's projection are as follows:

- Over the projection horizon, the per-barrel prices for oil in US dollars are assumed to be $85 for Brent, $80 for West Texas Intermediate and $65 for Western Canadian Select. These prices are all $5 higher than in the January Report.
- By convention, the Bank does not forecast the exchange rate in the *Monetary Policy Report*. The Canadian dollar is assumed to remain at 74 cents US over the projection horizon, close to its recent average and unchanged from the assumption in the January Report.
- Potential output growth in Canada is expected to slow from 2.5% in 2024 to about 1.6% on average over 2025 and 2026. Relative to the January Report, potential output growth has been revised up by 0.4 percentage points in 2024 and down by 0.3 percentage points in 2025. Details about the Bank's outlook for potential output growth are provided in the **Appendix** (page 26).
- The latest estimate for population growth in 2024 is close to 3%. Population growth is projected to average 1% in 2025 and 2026.[1] These estimates are based on population trends as well as the federal government's recently announced targets for non-permanent residents (see the **Appendix** and **Chart 2-A**). The government targets are taken as given, although at this point there are few details about how these targets will be achieved. Population growth is about 0.5 percentage points higher in 2024, but by the end of 2025 its level is roughly in line with the projection in the January Report.

1 These population estimates are for people aged 15 years and older. The recent estimate of historical population growth is benchmarked to Statistics Canada's quarterly population estimates. The projection over 2024 and 2025 combines information provided by Statistics Canada's Centre for Demography and the Bank of Canada's assumption that flows of permanent and non-permanent residents will evolve according to the announced federal government targets.

Chart 2-A: Growth of population of non-permanent residents declines in line with government targets

Annual changes from July 1 to June 30



Note: *Non-permanent residents* includes temporary foreign workers, international students and asylum seekers. *Other* includes natural changes to population (births and deaths), emigrants and returning emigrants.

Sources: Statistics Canada; Immigration, Refugees and Citizenship Canada; and Bank of Canada calculations

- Growth in real gross domestic product is estimated to be about 2¾% in the first quarter of 2024. As a result, the Bank estimates that the output gap is between -0.5% and -1.5% in the first quarter, which is roughly unchanged compared with the estimate for the fourth quarter of 2023.
- The projection incorporates all information from provincial and federal budgets that have been tabled at the time of writing. This includes new budgets from the provinces.
- The nominal neutral interest rate in Canada is estimated to be in the range of 2¼% to 3¼%, up 25 basis points from the January Report. The economic projection assumes that the neutral rate is at the midpoint of this range. Details about the Bank's annual assessment are provided in the **Appendix**.

The spread between prices for West Texas Intermediate and Western Canadian Select oil has narrowed recently. The smaller spread partly reflects the anticipated start of commercial operations for the Trans Mountain Expansion project, which is expected in the coming months.

The Bank of Canada's commodity price index excluding energy has risen slightly since the January Report, mostly due to increases in the prices of livestock and gold.

Canadian economy

Inflation is slowing as monetary policy works to reduce inflationary pressures. CPI growth was 2.8% in February, and core measures of inflation are now close to 3%. Key indicators of underlying price pressures are improving, but most have not yet fully normalized.

After essentially no growth in the second half of 2023, GDP is estimated to rebound in early 2024. Quarterly GDP growth is likely to be volatile around 2%. On an annual average basis, growth is 1.5% in 2024, supported by strong population growth. It then averages about 2% in 2025 and 2026 (**Table 2** and **Table 3**).

Growth in GDP per capita is expected to be negative in the first half of 2024, although it improves throughout the year and into early 2025. The pickup is driven by easing financial conditions, the fading effects of past increases in interest rates, and improving business and consumer confidence.

Potential output growth is robust in 2024. This reflects strong immigration, which more than offsets the ongoing weakness in productivity growth. Moderate excess supply in the Canadian economy is expected to remain through 2024. It starts to diminish in early 2025 as demand growth remains solid and supply growth moderates. The economy is expected to return to balance in 2026.

Table 2: Contributions to average annual real GDP growth
Percentage points*†

	2023	2024	2025	2026
Consumption	0.9 (1.2)	0.6 (0.3)	0.8 (0.9)	1.1
Housing	-0.9 (-0.9)	0.4 (0.4)	0.6 (0.5)	0.5
Government	0.5 (0.5)	0.7 (0.6)	0.7 (0.5)	0.4
Business fixed investment	-0.1 (0.1)	0.0 (-0.1)	0.3 (0.3)	0.2
Subtotal: final domestic demand	0.5 (0.9)	1.7 (1.2)	2.4 (2.2)	2.2
Exports	1.9 (1.6)	1.0 (0.3)	1.1 (1.3)	0.4
Imports	-0.3 (-0.3)	-0.6 (-0.1)	-1.0 (-0.9)	-0.6
Inventories	-1.0 (-1.2)	-0.6 (-0.6)	-0.3 (-0.2)	-0.1
GDP	1.1 (1.0)	1.5 (0.8)	2.2 (2.4)	1.9
Memo items (percentage change):				
Range for potential output	1.4–3.2 (1.4–3.2)	2.1–2.8 (1.0–3.2)	1.1–2.4 (1.0–3.2)	0.9–2.2
Real gross domestic income (GDI)	-1.0 (-1.0)	1.4 (0.3)	0.7 (1.4)	1.6
CPI inflation	3.9 (3.9)	2.6 (2.8)	2.2 (2.2)	2.1

* Numbers in parentheses are from the projection in the previous Report.

† Numbers may not add to total due to rounding.

Sources: Statistics Canada and Bank of Canada calculations and projections

Table 3: Summary of the quarterly projection for Canada*

	2023		2024			2023	2024	2025	2026
	Q3	Q4	Q1	Q2		Q4	Q4	Q4	Q4
CPI inflation (year-over-year percentage change)	3.7 (3.7)	3.3 (3.3)	2.8 (3.2)	2.9		3.3 (3.3)	2.2 (2.4)	2.1 (2.1)	2.1
Real GDP (year-over-year percentage change)	0.5 (0.5)	0.9 (0.7)	1.0 (0.2)	1.2		0.9 (0.7)	2.1 (1.6)	2.2 (2.7)	1.9
Real GDP (quarter-over-quarter percentage change at annual rates)†	-0.5 (-1.1)	1.0 (0.0)	2.8 (0.5)	1.5					

* Details on the key inputs to the base-case projection are provided in **Box 2**. Numbers in parentheses are from the projection in the previous Report.

† Over the projection horizon, 2024Q1 and 2024Q2 are the only quarters for which some information about real GDP growth was available at the time the projection was conducted. For longer horizons, fourth-quarter-over-fourth-quarter percentage changes are presented. They show the Bank's projected growth rates of CPI and real GDP within a given year. As such, they can differ from the growth rates of annual averages shown in **Table 2**.

Sources: Statistics Canada and Bank of Canada calculations and projections

Ongoing excess supply will help inflation return to target. Inflation is expected to fall gradually, passing below 2.5% in the second half of 2024 before reaching 2% in 2025. However, there is a meaningful risk that inflation could adjust more slowly. Inflation remains elevated for many services prices, especially for rent and mortgage interest costs.

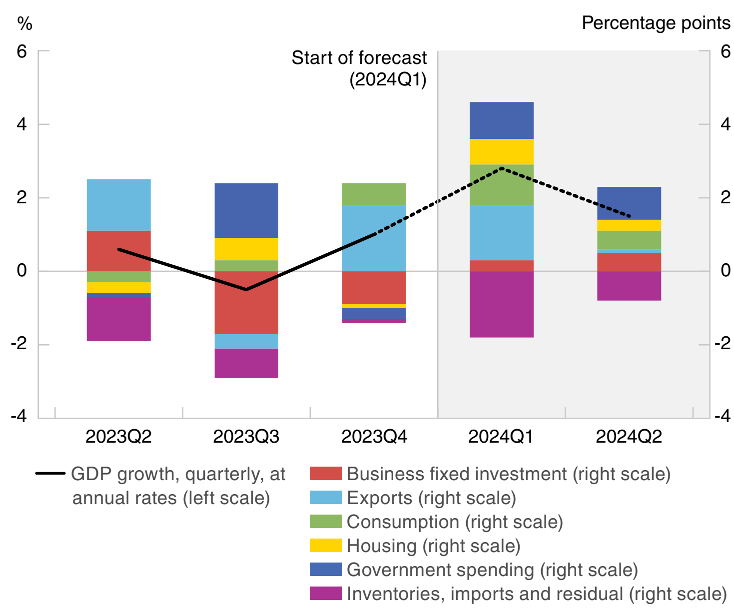
Economic growth picking up

GDP grew by roughly 1% in the fourth quarter, after contracting in the third quarter of 2023. Economic growth is on track to rise to roughly 2% on average over the first half of the year (**Chart 4**).

Growth in consumer spending is anticipated to average 1½% over the first half of 2024, driven mainly by strong population growth. In contrast, growth in consumption on a per capita basis continues to be negative. Spending

Chart 4: Real GDP is expected to pick up

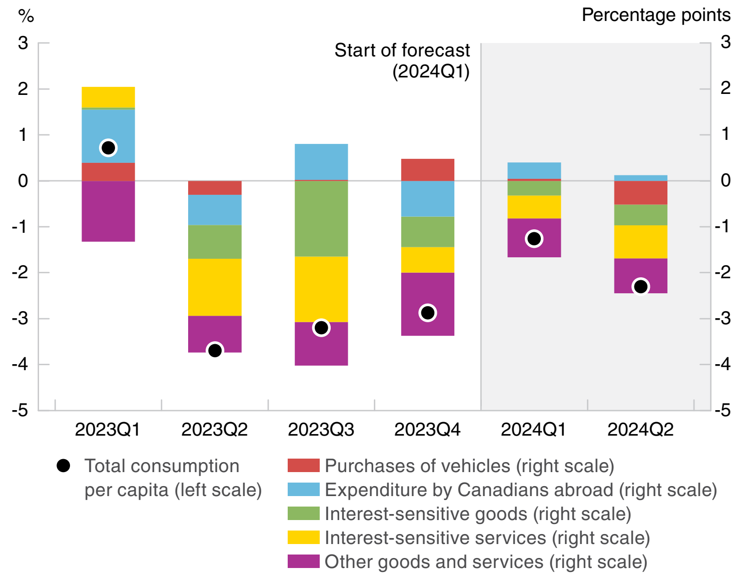
Contribution to real GDP growth, quarterly data



Sources: Statistics Canada and Bank of Canada calculations, estimates and projections

Chart 5: Growth of consumption per capita has been negative

Contribution to real consumption per capita growth (aged 15 and over), quarterly data



Note: Data for the population aged 15 and over are from Statistics Canada's quarterly estimates of population. For more information about what is included in the consumption categories, see T. Chernis and C. Luu, "Disaggregating Household Sensitivity to Monetary Policy by Expenditure Category," Bank of Canada Staff Analytical Note No. 2018-32 (October 2018).

Sources: Statistics Canada and Bank of Canada calculations

Last data plotted: 2024Q2

continues to be weak in categories sensitive to higher interest rates, such as furniture, food at restaurants and accommodation (**Chart 5**). But per capita spending growth becomes less negative in the first half of 2024 as the impact of past increases in interest rates diminishes. Residential investment is on track to strengthen in the first half of 2024 due to strong housing demand from population growth in an environment of tight supply.

Growth in government spending is projected to pick up from 2½% in the second half of 2023 to roughly 3½% in the first half of 2024. Growth is boosted by the return to work of Quebec public sector workers following the ratification of new collective agreements. Recently announced measures in provincial budgets are also expected to bolster demand starting in the second quarter of 2024.

Export growth is expected to be volatile in the first half of the year, impacted by cold weather disruptions and the timing of gold shipments. In addition, the start of commercial operations for the Trans Mountain Expansion project is expected to add roughly one-quarter of a percentage point to GDP growth in the second quarter. Business investment growth is expected to pick up modestly after a period of contraction.

Economy in excess supply

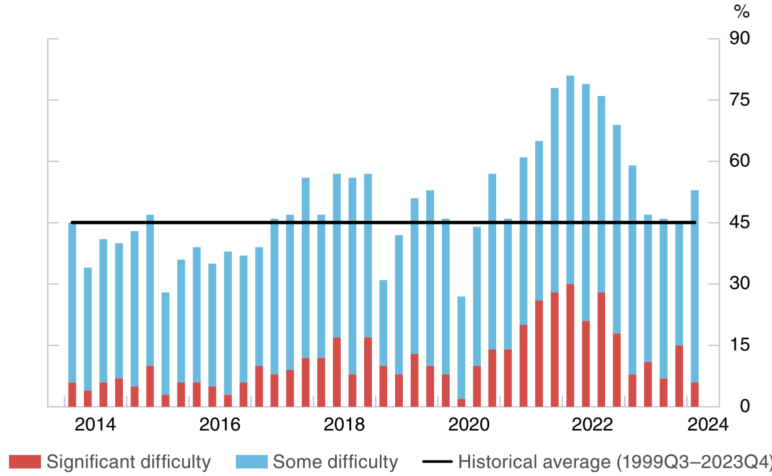
GDP growth is expected to remain roughly in line with potential output growth over the first half of 2024. Growth in potential output is estimated to expand robustly, at around 2½%, driven by the arrival of a large number of newcomers. As a result, the output gap is expected to remain between -0.5% and -1.5% in the first half of 2024. Businesses report an easing in capacity constraints compared with one year ago (**Chart 6**).

Labour market conditions are continuing to ease. Job creation has been slower than the increase in the working-age population (**Chart 7**). The unemployment rate has risen gradually to 6.1% in March. Both an increase in the length of time it takes for the unemployed to find a job and an increase in the job separation rate account for its rise. The job vacancy rate has declined to near pre-pandemic levels, and businesses report that labour shortages are below their historical average. Lastly, there are some signs that wage growth is beginning to ease.

Overall, the evidence suggests that the economy is in excess supply.

Chart 6: Capacity pressures for businesses have eased compared with one year ago

Percentage of respondents, Business Outlook Survey, quarterly data



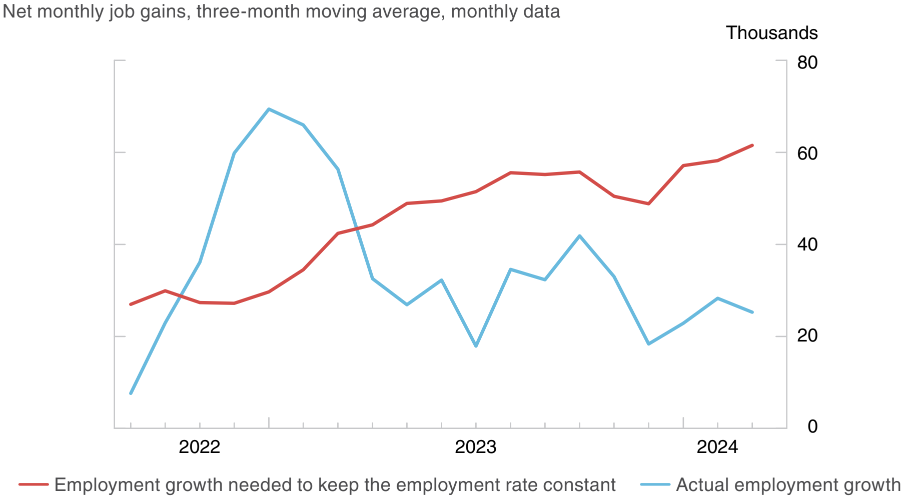
Note: This chart shows the percentage of respondents to the Business Outlook Survey reporting some or significant difficulty meeting an unexpected increase in demand or sales.

Source: Bank of Canada

Last observation: 2024Q1

Chart 7: Job creation has been slower than growth in the working-age population

Net monthly job gains, three-month moving average, monthly data



Note: *Employment growth needed to keep the employment rate constant* is calculated by multiplying the net monthly change in the size of the working-age population in the Labour Force Survey by the previous month's employment rate.

Sources: Statistics Canada and Bank of Canada calculations

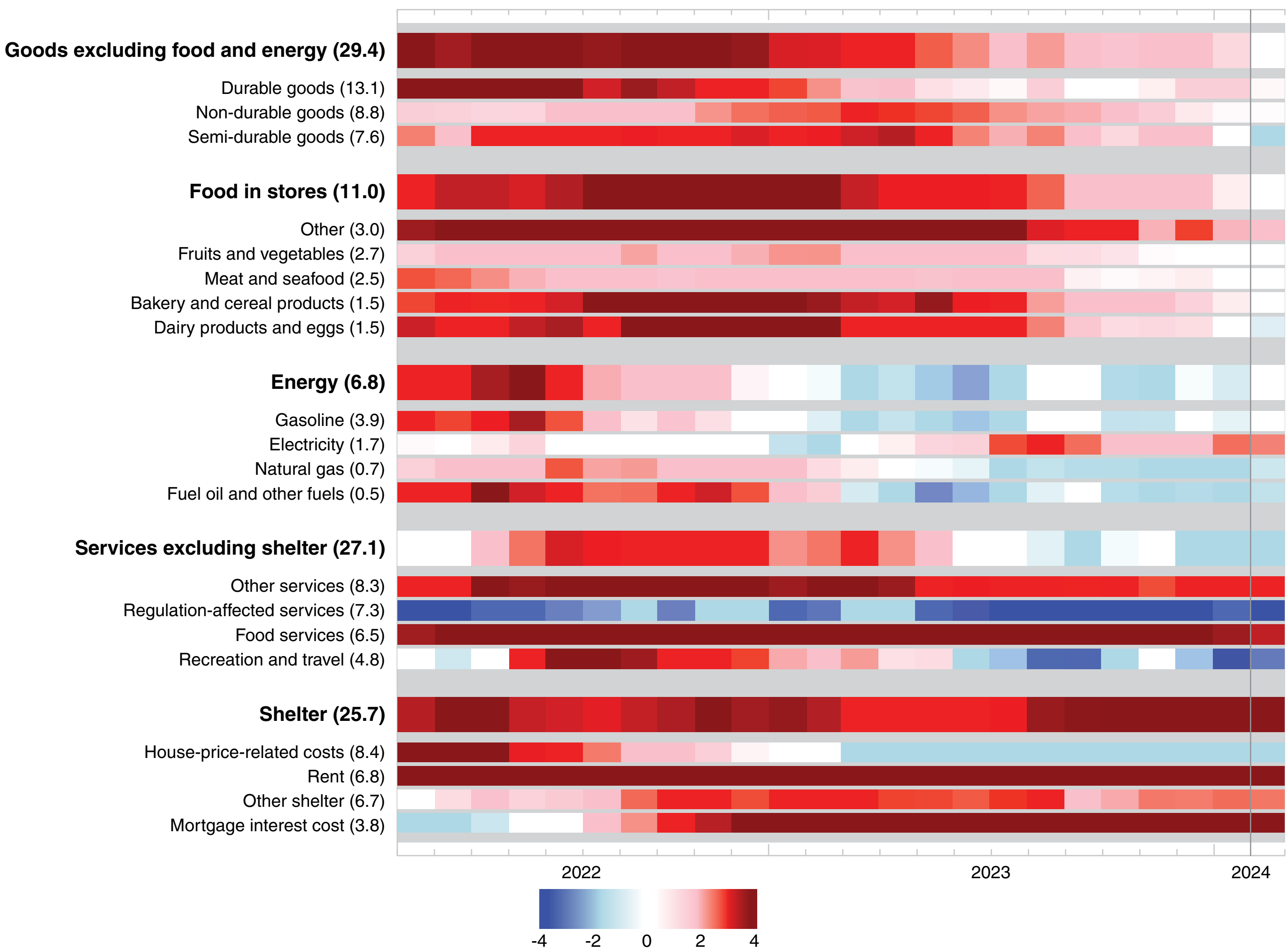
Last observation: March 2024

Inflation slowing but still elevated

CPI inflation declined from 8.1% in June 2022 to under 3% in January and February of this year. Inflation is now easing across most major categories, though the pace is uneven. The heatmap in **Figure 1** summarizes inflation across components of the CPI. Specifically, it assigns colours to show how far each component is from its historical average. It uses red for components that have relatively high inflation, blue for those with relatively low inflation and white for those that are close to their historical average.

- Inflation in the prices of goods excluding food and energy has declined broadly, helped by falling import prices, past declines in energy prices and slowing demand growth.
- Inflation in prices for food in stores has now slowed to roughly 2½%. Inflation in energy prices has fallen and is now in line with its historical average.

Figure 1: The decline in CPI inflation has been broad-based, although some components are persistently high



Note: The heatmap shows the distance of each CPI component's year-over-year inflation rate from its historical average. The colour is white when a component's inflation rate is close to its average, and is a varying shade of red (blue) when the rate is above (below) the average. Because the historical range of inflation varies widely across CPI components, each inflation rate plotted in the heatmap is standardized by subtracting its mean and dividing by its standard deviation. This standardization is conducted using data from 1996–2019, except for *Regulation-affected services* and *Other services*, where available data begin in 2004 and 2008, respectively. Note that *Regulation-affected services* includes prices that are affected by government regulations either directly (e.g., child care services) or indirectly (e.g., telephone services). Values in parentheses are CPI weights (in percent). Due to rounding, weights within categories may not add up to their respective totals.

Last observation: February 2024

Chart 8: Elevated inflation is becoming less broad-based

Share of CPI components with price growth above 3% over the past 12 months, monthly data

Sources: Statistics Canada and Bank of Canada calculations
Last observation: February 2024

- Inflation in prices for services excluding shelter is being pulled down by a sharp fall in regulation-affected services, which include communications prices. This is being partially offset by inflationary pressures from other components within this broader category (for example, food in restaurants and other services).
- Shelter services price inflation remains high at 7%, driven by increasing mortgage interest costs and strong growth in rent.[2]

Overall, the easing in inflation has been broad-based across CPI components, with a declining share of prices rising by more than 3%. However, this share remains somewhat above its historical average, largely due to services prices (**Chart 8**).

CPI-trim and CPI-median are now 3.2% and 3.1%, respectively. The strength in the price growth in many services is holding up core inflation. Momentum in CPI-trim and CPI-median has recently slowed, with annualized growth on a three-month basis of 2.3% and 2.1%, respectively (**Chart 9**). Core inflation should slow further in the coming months if three-month rates remain below the year-over-year rates.

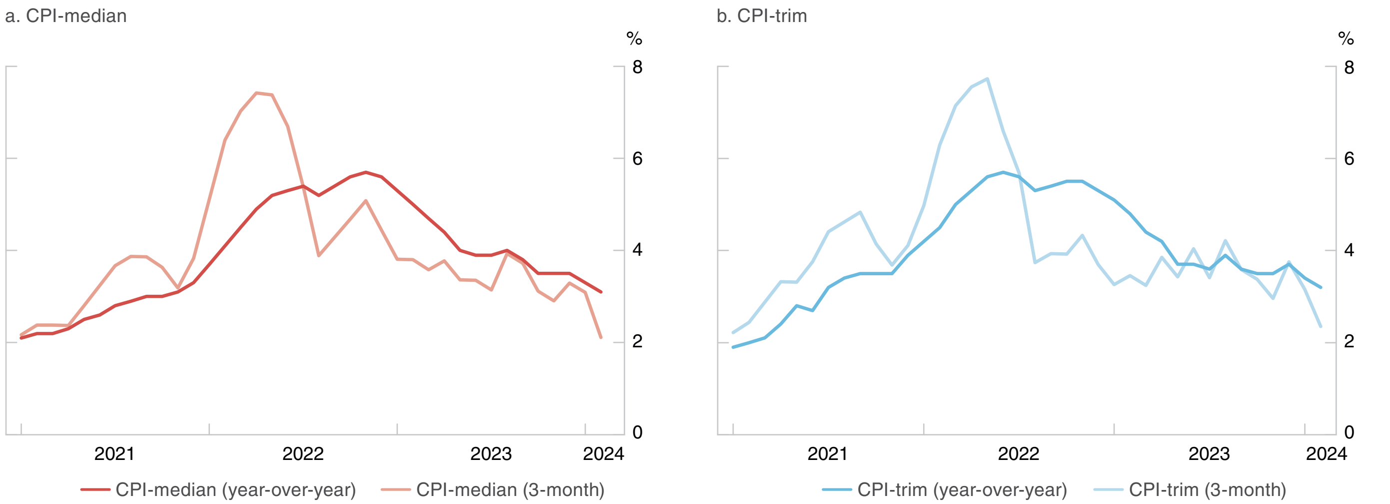
While three-month rates of core inflation can provide a timelier assessment of near-term inflationary pressures, they are also more volatile. This is why monetary policy ultimately focuses on the year-over-year rate of change in prices.

In the second quarter of 2024, inflation is expected to remain around 3% (**Chart 10**). On one hand, inflation for goods excluding food and energy is projected to continue to decline. On the other hand, communications prices are not expected to fall as much as in previous quarters. In addition, gasoline prices have increased in recent weeks due to factors such as the rise in global oil prices.

2 *Shelter services* excludes utilities other than water. This differs slightly from Statistics Canada's definition of shelter, which includes those utilities.

Chart 9: Core inflation is easing

Measures of core inflation, monthly data



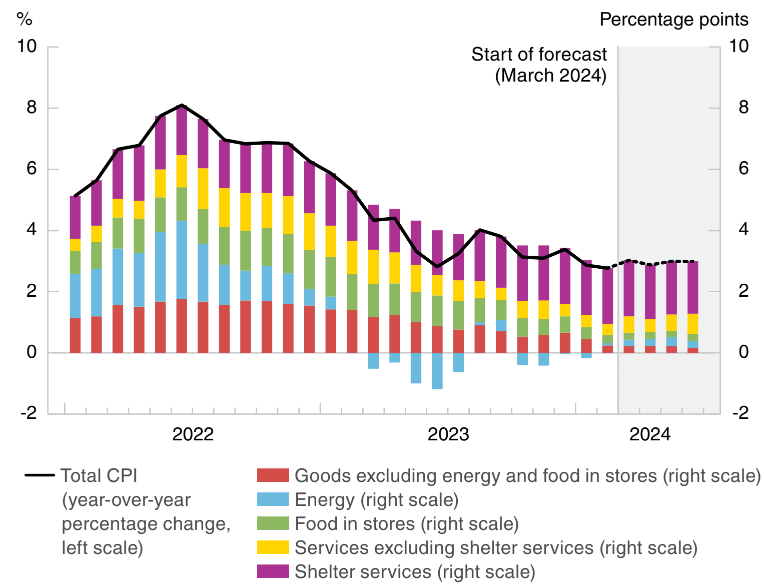
Note: More information about the CPI measures the Bank of Canada uses can be found on the Bank's website. Three-month rates are seasonally adjusted annual rates.

Sources: Statistics Canada and Bank of Canada calculations

Last observation: February 2024

Chart 10: CPI inflation is expected to remain close to 3% over the near term

Contribution to CPI inflation, monthly data



Sources: Statistics Canada and Bank of Canada calculations, estimates and projections

Last data plotted: June 2024

Inflation expectations and wage growth have eased

As inflation eases toward the 2% target, inflation expectations are anticipated to decline. Businesses' pricing behaviour is also expected to normalize further and wage growth to moderate. Progress has been made across these indicators, although some show more progress than others.

Inflation expectations easing

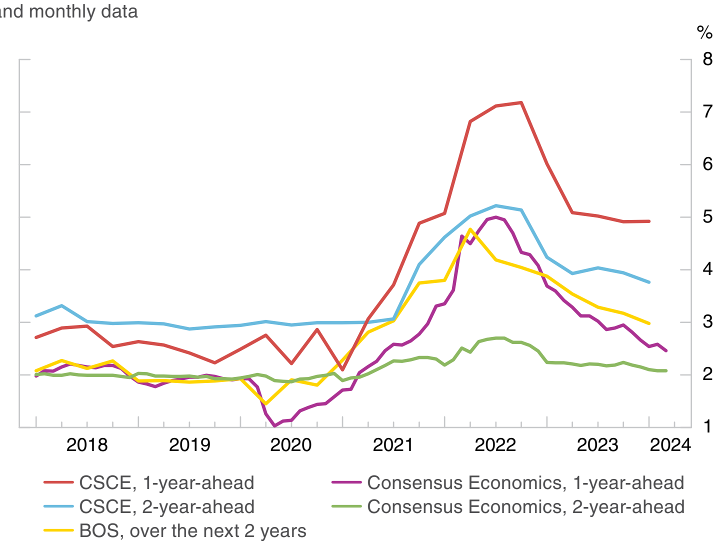
Near-term inflation expectations moderated over the first quarter of 2024 but remain elevated (**Chart 11**).

- Firms' short-term inflation expectations have declined to around 3%.
- Professional forecasters have eased their outlooks to close to 2.5%.
- In contrast, consumers' near-term inflation expectations have not declined significantly over the last year and remain well above their pre-pandemic levels.

Long-term expectations have remained consistent with inflation at the 2% target.

Chart 11: Most measures of near-term inflation expectations have come down

Quarterly and monthly data



Note: CSCE is the Canadian Survey of Consumer Expectations; BOS is the Business Outlook Survey. Consensus Economics' forecasts for the next year (based on monthly data) and the next two years (based on a combination of monthly and quarterly data releases) are transformed into fixed-horizon forecasts by the weighted average of fixed-date forecasts. *1-year-ahead* refers to inflation expectations for the next 12 months. *2-year-ahead* refers to inflation expectations for the period 13 to 24 months from now.

Sources: Consensus Economics, Bank of Canada and Bank of Canada calculations

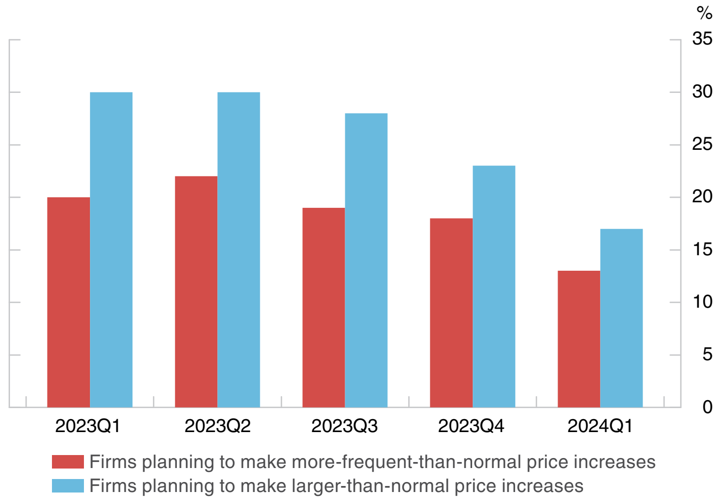
Last observations: Consensus Economics, March 2024; CSCE and BOS, 2024Q1

Normalizing price-setting behaviour

Businesses' price-setting behaviour is normalizing. Data on around 100,000 CPI goods and services prices show that the frequency of price changes rose during the pandemic and is now down from its peak (**Box 3**). Moreover, fewer businesses are planning unusually large price increases over the next 12 months (**Chart 12**).

Chart 12: The number of businesses that are planning unusually large or frequent price increases has steadily declined

Share of respondents, quarterly data



Note: *Firms planning to make more-frequent-than-normal price increases* is the percentage of firms responding to the Business Leaders' Pulse that are experiencing or expecting price increases that are more frequent than normal. Firms without regular pricing frequency are excluded from the frequency data. *Firms planning to make larger-than-normal price increases* is the percentage of firms responding to the Business Leaders' Pulse that are experiencing or expecting larger-than-normal price increases.

Source: Bank of Canada

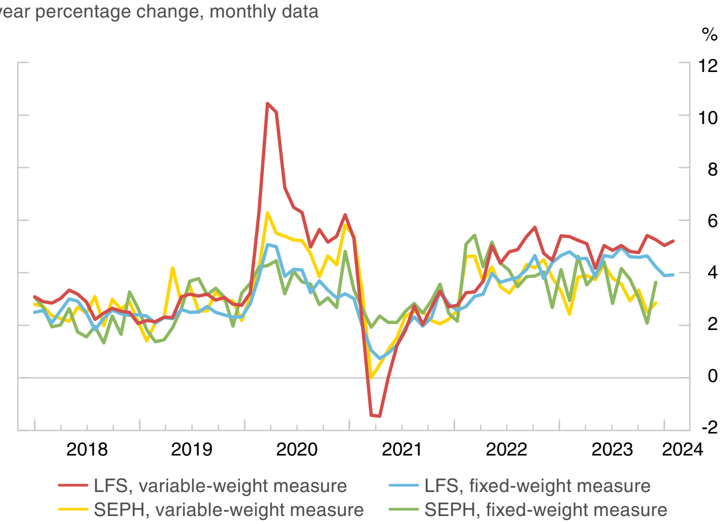
Last observation: February 29, 2024

Signs of softening wage growth

Wage growth is showing some signs of moderating. Most measures of wage growth have declined since the fourth quarter of 2023. The range of measures is now around 3½% to 4½%, as opposed to around 4% to 5% at the time of the January Report (**Chart 13**). However, for such wage growth to become compatible with the 2% inflation target, productivity growth would need to increase substantially.

Chart 13: Most measures of wage growth have declined modestly

Year-over-year percentage change, monthly data



Note: LFS is the Labour Force Survey; SEPH is the Survey of Employment, Payrolls and Hours. The LFS fixed-weight measure is constructed using 2019 employment weights.

Sources: Statistics Canada and Bank of Canada calculations

Last observations: LFS, March 2024; SEPH, January 2024

Box 3

Analyzing businesses' price-setting behaviour

Examining how businesses set their prices can provide insight into underlying inflationary pressures.

To better assess whether inflation is firmly on the path back to 2%, Bank of Canada staff analyzed the behaviour of prices of around 100,000 individual goods and services.[1, 2] By tracking how often and by how much Canadian retailers change their prices, staff can construct quantitative measures of businesses' price-setting behaviour. This work complements the Bank's business surveys, which provide insights into businesses' plans and expectations for price changes over the next 12 months.

Results of this recent analysis confirm that price-setting behaviour changed significantly throughout the COVID-19 pandemic and subsequent economic recovery. The analysis also indicates that businesses' pricing practices are normalizing.

Price-setting behaviour changed significantly

In the years leading up to the pandemic, the frequency of price changes was relatively stable. But in the early stages of the pandemic, businesses started to raise their prices more often (**Chart 3-A**). The frequency of price increases reached its peak in early 2022, before starting to ease in 2023.

One potential explanation for the rise in the frequency of price increases was the greater upward pressure on businesses' production costs. As demand recovered while supply remained constrained, businesses found it easier to pass on these cost increases in the form of higher prices.

Then as supply disruptions resolved, cost pressures eased and excess demand lessened, businesses raised their prices less frequently. Price decreases also became more frequent in this environment.

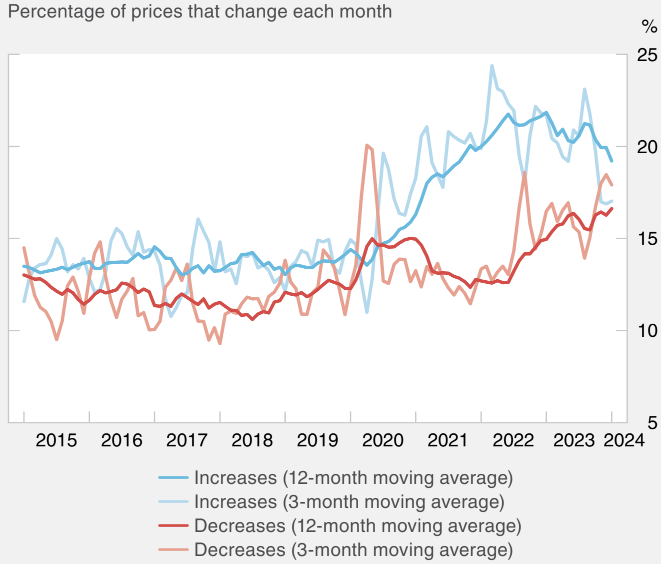
The increase in the frequency of price changes may also be partly due to changes in recent years in the methodology used to sample the price data. Statistics Canada modified some of its price-collection practices, including relying more on scanner data and looking more at online rather than in-store prices. These adjustments may have increased the likelihood that price changes would be detected. Technological advances may also be making it possible for retailers to raise and lower their prices more frequently.

Bank staff recognize the potential bias that could come from the change in sampling methodology or from other changes that could affect the frequency of price adjustments in either direction. Because of this, their analysis focuses on the *relative frequency of price increases and decreases* as a summary indicator of pricing behaviour (**Chart 3-B**).[3] This measure, which tracks inflation closely, reached its historical high in June 2022, coinciding with the recent peak for inflation in consumer price index (CPI) components excluding shelter. Although both the size and frequency of price changes have experienced large swings since the pandemic began, detailed analysis suggests that the frequency of changes has been more important in explaining recent inflation dynamics.

(*continued…*)

Chart 3-A: Businesses started to raise their prices more frequently during the pandemic

Percentage of prices that change each month



Sources: Statistics Canada and Bank of Canada calculations
Last observation: January 2024

1 Although this dataset is intended to provide a close approximation of the official consumer price index (CPI) database, it does not contain all the data from which the CPI is produced. In particular, it excludes shelter prices, which are seen as less relevant for examining corporate price-setting practices.

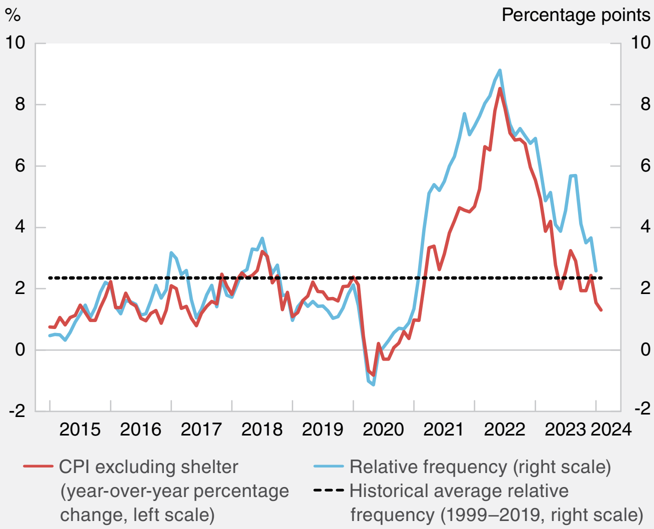
2 For more details, see O. Bilyk, M. Khan and O. Kostyshyna, "Pricing behaviour and inflation during the COVID-19 pandemic: Insights from consumer prices microdata," Bank of Canada Staff Analytical Note No. 2024-6 (April 2024).

3 The relative frequency of price increases and decreases is defined as the percentage of prices that are increasing minus the percentage of prices that are decreasing.

Box 3 (*continued*)

Chart 3-B: Relative frequency of price changes has moved in line with actual inflation

Monthly data

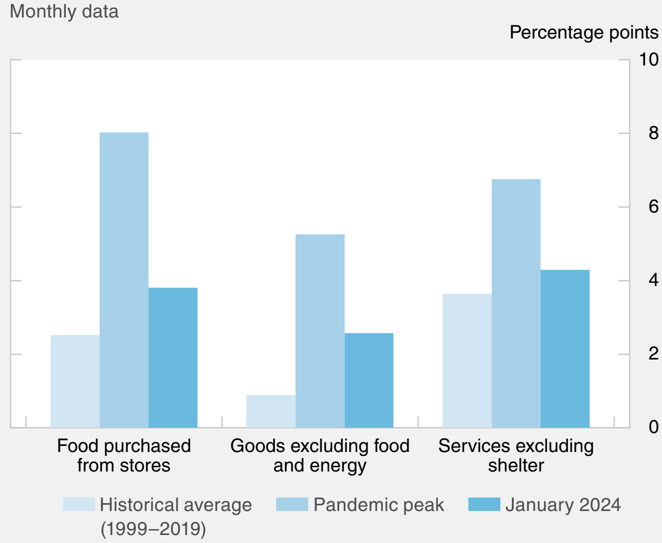


Sources: Statistics Canada and Bank of Canada calculations

Last observation: CPI excluding shelter, February 2024; Relative frequency, January 2024

Chart 3-C: Relative frequency of price changes has declined from its peak

Monthly data



Sources: Statistics Canada and Bank of Canada calculations

Last observation: January 2024

How close are we to normal pricing behaviour?

The relative frequency of price changes has declined significantly from its peak during the pandemic, nearing historical average levels (**Chart 3-B**). Further normalization appears possible, however. This is most evident for goods excluding food and energy, the category with the largest remaining gap relative to its historical average (**Chart 3-C**).[4]

Pricing behaviour is normalizing and should continue to do so in the coming months, with the economy expected to remain in excess supply and growth in input costs slowing. These findings are broadly consistent with the Bank's business surveys, which show that fewer businesses are planning unusually large or frequent price increases over the next year.

4 Note that the gap for total inflation is very small as of January 2024, partly because the relative frequency of price increases and decreases for energy (not shown in **Chart 3-C**) is very negative. Progress in non-energy categories has been significant but not as pronounced.

Economic growth projected to strengthen

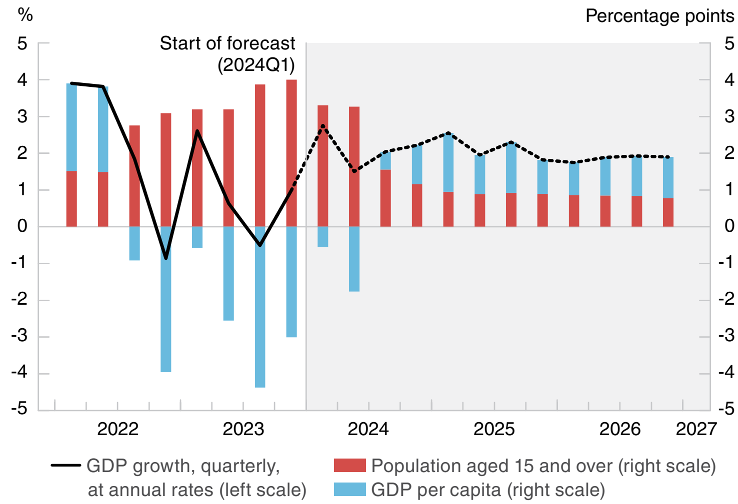
GDP growth is anticipated to strengthen from about 2% in the first half of 2024 to a peak of 2½% in early 2025 (**Chart 14**). This growth profile is underpinned by an increase in GDP per capita, which comes about due to an easing in financial conditions and a rise in confidence. GDP growth eases over the rest of 2025 and into 2026 to around 2%, somewhat above the projected growth of potential output.

The outlook for GDP growth is revised up, mainly due to stronger-than-expected population growth in 2024. In addition, government spending is revised up, while stronger US demand points to higher export growth (**Box 1**).

Potential output is estimated to have expanded in the first quarter of 2024 by roughly 2¾%, driven by the recent increase in the number of newcomers to Canada. It is projected to then slow to around 1½% in 2025 and 2026. This slowdown is due to a rapid reduction in arrivals of new non-permanent

Chart 14: GDP per capita growth picks up

Contribution to real GDP growth, quarterly data



Note: Data for the population aged 15 and over are from Statistics Canada's quarterly estimates of population.
Sources: Statistics Canada and Bank of Canada calculations, estimates and projections

residents, in line with the federal government's recently introduced targets for this group. A modest pickup in labour productivity growth partially offsets the slowdown in population growth. The projection reflects the results of the Bank's latest annual assessment of the drivers of potential output (**Appendix,** page 26).

As a result, excess supply is expected to remain in the -0.5% to -1.5% range through 2024 and then slowly dissipate in 2025 and 2026.

Growth in consumption per capita to recover

Consumption growth is expected to be boosted by population growth in the first half of 2024 and is then to ease through the rest of the year. Consumption growth slows because population growth declines from more than 3% in the first half of the year to 1½% in the second half. This is partially offset by growth in consumption per capita, which recovers from about -2% at the beginning of the year to close to zero by the end of the year. The anticipated improvement in per capita consumption growth comes as the drag from debt-servicing costs diminishes.

Overall consumption growth is then expected to gradually rise over 2025 and stabilize around 2% in 2026. Spending growth continues to increase as the impact of debt-servicing costs on income growth declines more, the net worth of households rises and confidence improves.

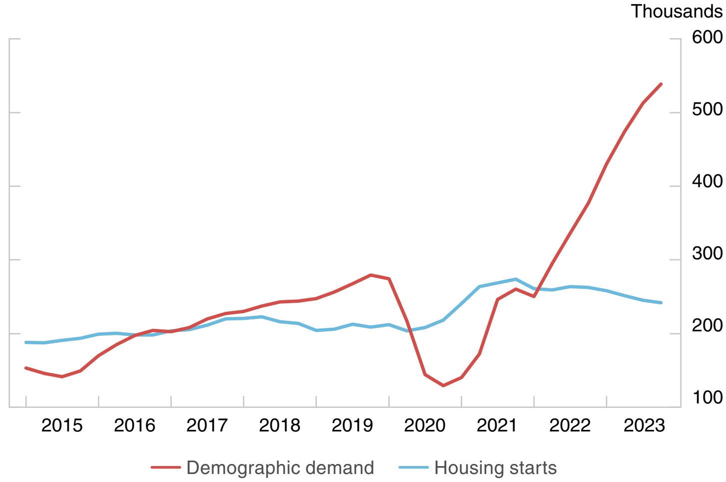
Robust growth in residential investment

Growth in residential investment is expected to rise over the second half of 2024 and expand to around 8% through 2025. It then slows to 5% in 2026. Housing activity, including new construction, is driven by the recent strength in population growth and an ongoing shortfall in housing supply that is not expected to close over the projection horizon (**Chart 15**). Support for residential investment also comes from easing financial conditions and the waning effects of past increases in interest rates. The supply of new housing construction is supported by recently announced government policies.

Tight supply leads to moderate growth in house prices over the next two years. Price growth is then expected to slow as new construction picks up and population growth eases.

Chart 15: Housing starts have been well below demographic demand

Four-quarter moving average, quarterly data



Note: *Demographic demand* is a measure of demand for housing based on the number of new households per quarter.

Sources: Canada Mortgage and Housing Corporation, Statistics Canada and Bank of Canada calculations

Last observation: 2023Q4

Business investment and export growth to pick up and then moderate

Growth in business investment is expected to pick up further in the second half of 2024. Capital expenditure plans include more spending on projects tied to electric vehicles, petrochemicals, and oil and gas. Business investment growth is expected to then moderate over 2025 and 2026.

Spending is underpinned by the diminishing impact of past increases in interest rates, easing financial conditions and the overall growth of the economy. Business investment is also supported by the increased population as companies spend more to ensure new workers have the equipment and tools to do their jobs.

Exports are being supported by strong demand from the United States. Export growth is anticipated to be temporarily boosted to around 4½% in the second half of 2024. This is because:

- Energy export growth surges as the newly opened Trans Mountain Expansion pipeline increases export capacity.
- Motor vehicle export growth starts to ramp up as the retooling of auto sector plants is partly completed.

Export growth is then expected to decline slowly through 2025 and average around 1% in 2026.

Growth in imports is expected to pick up in the second half of 2024 to around 5%. The increase is driven largely by the import of parts and materials needed to ramp up motor vehicle production. Import growth then moderates to around 2% over 2025 and 2026, in line with growth in domestic demand.

Inflation projected to reach target in 2025

In the second half of 2024, inflation is projected to ease to below 2.5%, led by slower price growth for shelter and food.

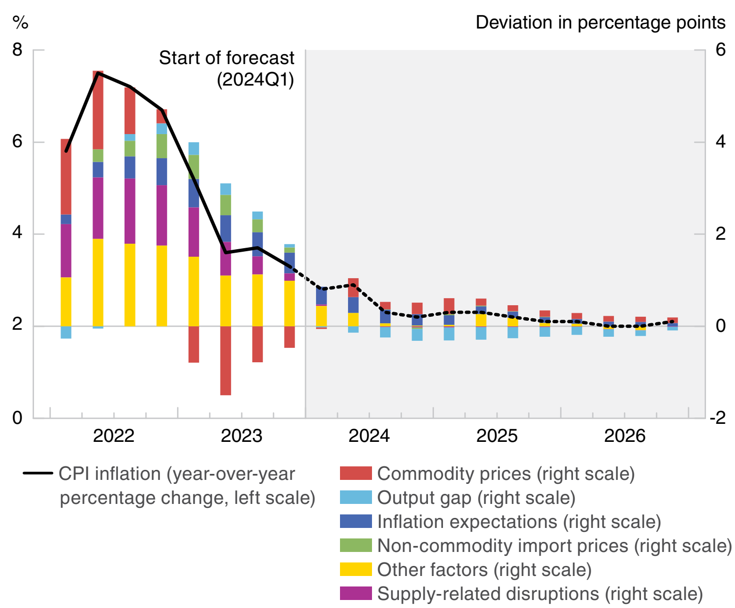
Shelter services price inflation is anticipated to moderate as growth in mortgage interest costs diminishes. It does so as financial conditions ease and the impact of additional households renewing and taking on new mortgages decreases. However, shelter services price inflation is expected to remain elevated, due to still-high mortgage interest costs and rental price inflation. Food price inflation is expected to moderate further, driven by past declines in global prices for agricultural products.

In contrast, inflation in prices for goods excluding food and energy and inflation in prices for services excluding shelter are both expected to remain stable. The latter reflects two offsetting forces. On one hand, inflation in many services prices is expected to moderate as labour market pressures ease and growth in labour costs slows. On the other hand, the deflation in communication prices is projected to moderate.

Inflation is projected to return to the 2% target in 2025 due to the impact of ongoing excess supply (**Chart 16**). Labour costs are projected to moderate further as wage growth continues to slow, bringing it in line with inflation and modest productivity growth. Moreover, with demand pressures in check, businesses will find it more difficult to pass on their cost increases to consumers. In this environment, inflation expectations decline further, consistent with the 2% inflation target.

Chart 16: CPI inflation is forecast to return to target in 2025

Contribution to the deviation of year-over-year inflation from 2%, quarterly data



Note: *Non-commodity import prices* includes the impact of the Can$/US$ exchange rate. *Other factors* could include underestimated demand pressures, such as from large imbalances in the housing market, or previously unobserved factors, such as greater pass-through from oil or import prices and atypical pricing behaviour by firms. The impact of the carbon price on year-over-year inflation is roughly 0.1 percentage point over the projection horizon and is included in *Commodity prices*. Numbers may not add to total due to rounding.

Sources: Statistics Canada and Bank of Canada calculations, estimates and projections

Risks to the inflation outlook

The Bank considers the outlook in the base-case scenario to be the most likely outcome for inflation. There are both upside and downside risks to this outlook. Overall, the Bank views the risks to inflation to be balanced. With inflation continuing to be above target, the Bank is more concerned about the upside risks.

Progress has been made on most indicators of underlying inflation, which suggests the risk of inflation remaining too high has diminished. At the same time, economic activity has been stronger than expected, lessening the risk of a sharp slowing in the economy.

The projection for real GDP growth depends heavily on the assumed path of population growth (**Box 2**). The federal government recently announced plans to reduce arrivals of new non-permanent residents. However, details of how these plans will be implemented have yet to be announced, so there is some uncertainty about the outlook for population growth. While this matters a lot for real GDP growth, it will have a much smaller impact on inflation. This is because higher population affects both overall supply and demand. Nonetheless, rapid changes in population can have implications for some components of the CPI.

Main upside risks

There are three upside risks to the outlook for inflation: higher house prices, elevated cost pressures and geopolitical developments.

Housing prices could rise sharply

House prices could increase more than anticipated due to strong demand, which would boost inflation by raising shelter costs. The base case includes a moderate increase in house prices, somewhat higher than the forecast in the January Report. But house prices could rise faster than forecast if easing financial conditions or population growth leads to stronger-than-expected demand for housing while supply remains constrained. Sustained expectations for large increases in housing prices could amplify this risk.

Elevated cost pressures could remain

In the projection, labour costs are expected to moderate, with wage growth slowing as inflation eases and productivity growth improves. However, it is unclear whether this recent softening in wage growth will continue. At the same time, productivity growth has continued to trend lower. If wage growth does not slow, or if productivity remains weak, firms will continue to face elevated cost pressures. In turn, this could lead to higher inflationary pressures. This is particularly relevant for some services components of the CPI, where inflation remains elevated.

Geopolitical tensions could worsen

New international trade disruptions stemming from global tensions and conflicts, including wars in the Middle East and in Ukraine, could impact global commodity prices and impede the supply of traded goods. If these disruptions persist or worsen, they could delay the return of inflation back to target by increasing production costs and prolonging elevated inflation expectations.

Main downside risks

As in the January Report, a more pronounced slowdown in the Canadian economy is the main downside risk to inflation.

Monetary policy could have a larger impact

The effects of past increases in interest rates on economic activity and inflation could be larger than in the base case. Given upcoming mortgage renewals and record-high levels of household debt, Canadians could become more cautious and cut back consumption spending more than projected. In turn, slowing demand combined with tight financial conditions could make Canadian businesses less willing to invest or to hire new workers.

Global growth could be weaker

Global activity could be weaker than in the base case. This could occur if central banks in the United States and Europe need to keep monetary policy tighter than assumed to bring inflation back to target. In China, high debt levels and challenges with managing credit risk may further weaken lending and growth. This could lower global demand and reduce the prices of commodities and tradable goods. Canadian economic growth and inflation would be pulled down if these risks were to materialize.

Goods price inflation could slow more than expected

Inflation in the prices of intermediate and final goods could weaken more than expected. Goods price inflation has slowed significantly since the middle of 2022. There is a risk that inflation for many goods prices could ease even further. Goods inflation could be affected if the prices of China's exports fall by more than currently assumed and those price changes are then passed on to consumers. Demand for goods, which remains elevated compared with pre-pandemic levels, could also soften more than anticipated. This could put additional downward pressure on goods prices. This is particularly the case in the United States.

Appendix: Potential output and the nominal neutral rate of interest

Potential output growth in Canada is estimated to rise temporarily in 2024, mostly due to strong population growth, while productivity growth remains weak (**Table A-1**). Compared with the April 2023 Report, the Bank's estimate of potential output growth has been revised up in 2024, and down in 2025 and 2026. The Bank's estimate of the neutral rate has been revised up.[3]

Table A-1: Projection for potential output growth
Projected growth† (%)

	2023	2024	2025	2026	2027
Canada	2.3	2.5 (2.1)	1.7 (2.1)	1.5 (2.2)	1.7
United States	2.3 (1.8)	2.3 (1.8)	2.2 (1.8)	2.1 (1.7)	2.1
Euro area‡	1.3	1.2	1.1	1.1	1.1
Japan	0.6	0.6 (0.7)	0.7 (0.8)	0.7	0.7
China	4.6 (4.7)	4.3 (4.5)	4.1 (4.3)	3.9 (4.2)	3.8
Oil-importing EMEs§	3.6 (3.5)	3.9 (3.7)	4.1 (3.7)	4.1 (3.9)	4.1
Rest of the world◊	1.9 (1.3)	2.1 (1.7)	2.1 (1.7)	2.0 (1.8)	2.0
World	2.9 (2.7)	3.0 (2.8)	3.0 (2.8)	2.9 (2.8)	2.9

† Numbers in parentheses are projections used in the April 2023 Report and are reported only when different from the current projection.

‡ Croatia joined the euro area on January 1, 2023. The current projection and historical data include the change in membership.

§ The oil-importing emerging-market economies (EMEs) grouping excludes China. It is composed of large EMEs from Asia, Latin America, the Middle East, Europe and Africa (such as India, Brazil and South Africa) as well as newly industrialized economies (such as South Korea).

◊ "Rest of the world" is a grouping of other economies not included in the first five regions. It is composed of oil-exporting EMEs (such as Russia, Nigeria and Saudi Arabia) and other advanced economies (such as Canada, the United Kingdom and Australia).

Source: Bank of Canada calculations and projections

3 For more details, see T. Devakos, C. Hajzler, S. Houle, C. Johnston, A. Poulin-Moore, R. Rautu and T. Taskin, "Potential output in Canada: 2024 assessment," Bank of Canada Staff Analytical Note (forthcoming); and F. Adjalala, F. Alduino Alves, H. Desgagnés, W. Dong, D. Matveev and L. Simon, "Assessing the US and Canadian neutral rates: 2024 update," Bank of Canada Staff Analytical Note (forthcoming).

Canadian potential output growth to strengthen in 2024, then slow

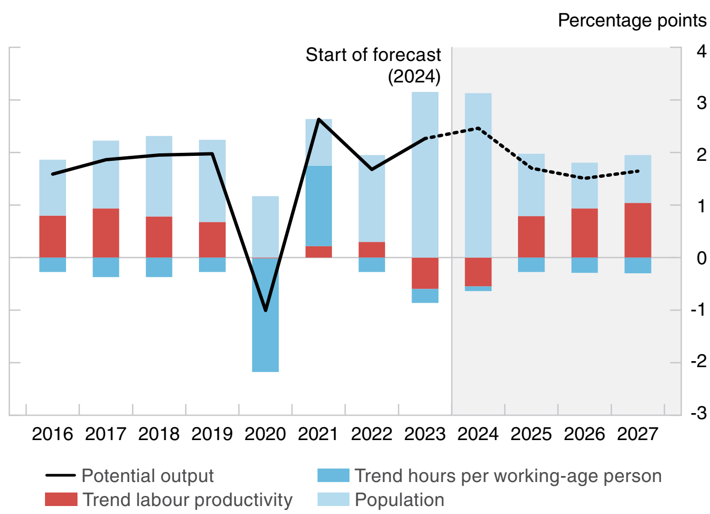
Potential output refers to the maximum sustainable level of output that is consistent with inflation at the 2% target. It is influenced by structural factors such as demographic change, education, innovation, technology and the stock of capital.

In Canada, growth of potential output is expected to increase from 2.3% in 2023 to 2.5% in 2024 and to stabilize at just above 1½% over the period 2025–27 (**Chart A-1**, **Table A-2**).

The growth of trend labour input is estimated to contribute 3.0 percentage points to potential output growth in 2024. Its contribution then falls to about 0.9 percentage points in 2025 and to around 0.6 percentage points in 2026 and 2027. The initial rise in trend labour input growth reflects the sharp increase in the population due to the expanding number of permanent and non-permanent residents arriving in 2023 and 2024. The subsequent slowdown mainly reflects slower growth in the number of newcomers, which is consistent with the federal government's recently announced targets for non-permanent residents.

Chart A-1: Potential output growth is expected to moderate

Annual contribution to potential output growth



Sources: Statistics Canada and Bank of Canada calculations, estimates and projections

Table A-2: Comparison of Canadian potential output estimates relative to April 2023

Annual rates (%)

	Annual growth	Trend labour input growth	Trend labour productivity growth	Range for growth	Revisions to the level (percent)
2023	2.3 (2.3)	2.9 (1.5)	-0.6 (0.8)	1.4–3.2	0.8
2024	2.5 (2.1)	3.0 (1.3)	-0.5 (0.8)	2.1–2.8	1.2
2025	1.7 (2.1)	0.9 (1.2)	0.8 (0.9)	1.1–2.4	0.8
2026	1.5 (2.2)	0.6 (1.2)	0.9 (1.0)	0.9–2.2	0.1
2027	1.7	0.6	1.0	1.1–2.4	—

Notes: Estimates from the April 2023 assessment appear in parentheses. The range for potential output growth represents the methodological range implied by the risk scenarios presented in T. Devakos, C. Hajzler, S. Houle, C. Johnston, A. Poulin-Moore, R. Rautu and T. Taskin, "Potential output in Canada: 2024 assessment," Bank of Canada Staff Analytical Note (forthcoming).

Trend labour productivity (TLP) growth is estimated to have fallen in 2023, pulling potential output growth down by 0.6 percentage points. This weakness in TLP growth is expected to continue in 2024. Large increases in the size of the working-age population as well as modest business investment have led to a decline in the stock of capital per worker in 2023 and 2024. With population growth expected to normalize in 2025 and beyond, and investment to pick up, trend labour productivity growth is expected to gradually improve.

Compared with the estimate in the April 2023 Report, potential output growth is revised up by 0.4 percentage points in 2024, and revised down by 0.6 percentage points on average in 2025 and 2026.[4] The positive revision in 2024 reflects the arrival of more newcomers to Canada than previously expected. This is moderated by downward revisions to capital deepening and trend total factor productivity growth.

To capture long-term structural shifts in the economy, trend total factor productivity growth has been revised down from the April 2023 assessment. Going forward, the contribution to total factor productivity growth from the mining, oil and gas sector and the manufacturing sector is expected to slow, while the contribution of the services sector is likely to remain stable.[5]

Estimates of potential output are highly uncertain because some of its components are unobservable and difficult to forecast. To reflect this uncertainty, a range is constructed around the midpoint estimates. The outlook for potential output is subject to both upside and downside risks. In particular, this reflects uncertainty around the:

- future pace of international migration
- strength of investment
- impact of other structural factors (for example, changes in the composition of the labour force due to a higher number of non-permanent residents)

Steady growth in global potential output

Growth of global potential output is projected to remain broadly stable near its 2023 rate of 3% over the projection horizon.[6]

In the United States, potential output growth is estimated to have risen from 2.0% in 2022 to 2.3% in 2023 due to an increase in trend labour input growth, driven by strong net immigration. Potential output growth is expected to remain at 2.3% in 2024 before gradually easing as the pace of immigration slows. TLP growth remains broadly stable at around 1.3% over the projection—close to its average over the past two decades.

Potential output growth slows in China due to a slowdown in investment growth linked to ongoing weakness in the property sector. Meanwhile, foreign direct investment is expected to weaken as countries diversify their supply chains. In contrast, potential output growth continues its steady rise in oil-importing emerging-market economies. Investment is expected to strengthen in these economies as domestic monetary conditions ease and as some

4 These revisions include the effects of developments throughout 2023, many of which were already incorporated in the January 2024 projection. For example, the impacts of historical revisions to the national accounts data on potential output were incorporated in the January Report. **Box 1** discusses the revisions relative to January.

5 For more details, see D. Brouillette, T. Devakos and R. Wheesk, "Total factor productivity growth projection for Canada: A sectoral approach," Bank of Canada Staff Analytical Note (forthcoming).

6 For more details, see A. A. Benmoussa, R. Dastagir, E. Ekanayake, J.-D. Guénette, H. Lao, J. Rolland-Mills, A. Spencer and L. Xiang, "Assessing global potential output growth: April 2024," Bank of Canada Staff Analytical Note (forthcoming).

countries diversify their supply chains away from China. Labour input growth is expected to increase due to steady improvement in trend labour force participation.

In the euro area, potential output growth moderates from 1.3% in 2023 to around 1.1% over 2024–27. This reflects declining trend labour input growth due to population aging. Potential output growth in the euro area is lower than in the United States because of a weaker outlook for trend labour input growth and a lower rate of labour productivity growth.

Overall, the Bank is projecting a higher rate of growth for global potential output than in the April 2023 Report. This is due to several factors.

First, an upward revision to capital deepening raises potential output growth in emerging-market economies and rest-of-the-world regions.[7] This is because private and public investment are proving to be stronger than anticipated, partly due to increased investment as countries diversify their supply chains. A stronger outlook for non-oil investments in Saudi Arabia also provides a boost. The upward revision to capital deepening accounts for most of the change in the outlook for global potential output growth, given these regions' large share of global GDP. An upward revision to trend labour input growth is also a major contributor to the upward revision in growth in emerging markets.

Second, population growth in the United States is forecast to be faster than assumed in the April 2023 Report due to a more rapid pace of immigration. The labour force participation rate is also stronger, partly because of a larger share of foreign-born workers, who tend to have higher participation rates than workers born in the United States. As a result, trend labour input is higher and is projected to grow considerably faster than previously assumed. US potential output growth is therefore revised up by about 0.5 percentage points on average from 2023 to 2026.

Third, potential output growth in China is lower due to downward revisions to population growth rates and lower productivity. The weaker outlook for productivity is due to reduced foreign direct investment and policy uncertainty that impacts innovation and technology diffusion.

Overall, annual global potential output growth is about 0.2 percentage points higher on average from 2023 to 2026.

Higher neutral rate of interest

The nominal neutral interest rate is defined as the real neutral rate plus 2% for inflation. The real neutral rate is the rate to which the policy rate would converge in the long run, when output is sustainably at its potential and inflation is at target (i.e., after all cyclical shocks have dissipated). It is a medium- to long-term equilibrium concept.

The Bank estimates that the nominal neutral rate in Canada has risen to lie within a range of 2.25% to 3.25%, which is 25 basis points higher than in the April 2023 assessment. The midpoint estimate consists of a 2% inflation target and a 0.75% real neutral rate. This increase reflects the impacts of an upward revision to the US neutral rate and changes in key Canadian domestic factors.

7 See **Table 1** for more information about countries considered to belong to the emerging-market economies grouping and in the rest-of-the-world grouping.

Because Canada is a small open economy, its neutral rate of interest is influenced by global economic conditions. The Bank uses an estimate of the neutral rate for the United States as a proxy for the global neutral interest rate. The nominal US neutral rate is currently estimated to be within a range of 2.25% to 3.25%. The current estimate of the neutral rate is 25 basis points higher than in the April 2023 Report and is largely explained by the stronger US potential output growth driven by higher population and productivity growth. To a lesser extent, higher government debt has also contributed to the higher neutral rate.

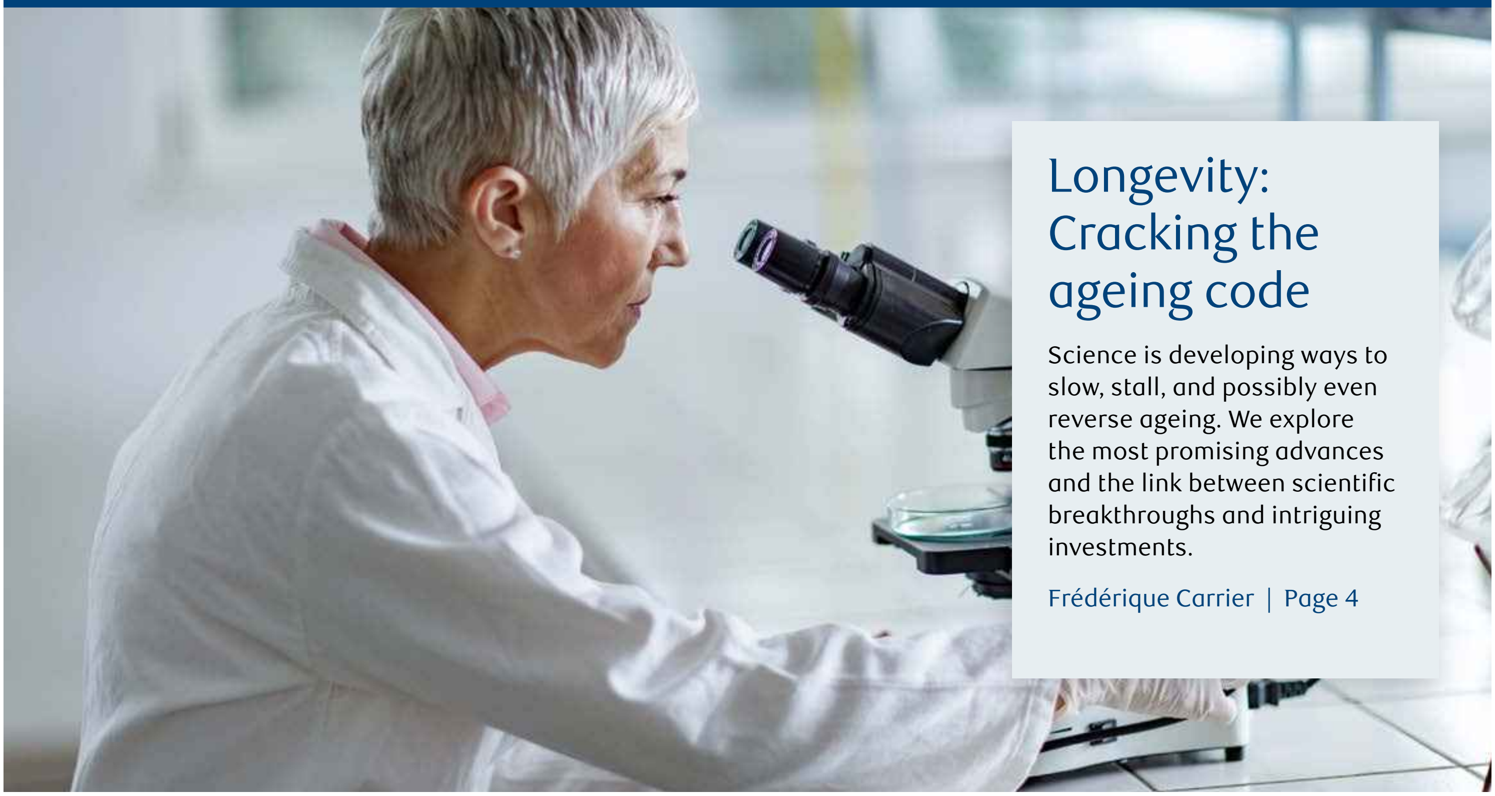
For Canada, stronger average growth in trend labour input exerts upward pressure on the Canadian neutral rate. Population growth matters, not only because of its impact on growth in the labour force but also because of how it affects the composition of borrowers and savers. A fast-growing population increases the proportion of young borrowers relative to middle-aged and older savers, and this puts upward pressure on the neutral rate. However, offsetting this pressure is weaker growth in TLP.

Like potential output, the neutral rate is unobservable and can be inferred only by assessing the evolution of observed data. Considerable uncertainty surrounds its estimation. This reflects the uncertainty around the factors that drive it, such as potential output and the balance between savings and investment.

GLOBAL Insight

Perspectives from the Global Portfolio Advisory Committee

June 2024



Longevity: Cracking the ageing code

Science is developing ways to slow, stall, and possibly even reverse ageing. We explore the most promising advances and the link between scientific breakthroughs and intriguing investments.

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For important and required non-U.S. analyst disclosures, see page 17.

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All values in U.S. dollars and priced as of market close, May 31, 2024, unless otherwise stated.

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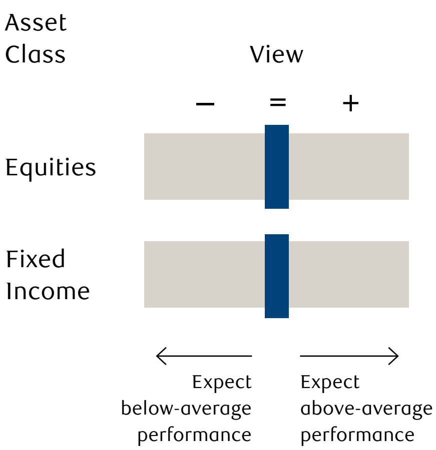

(+/=/–) represents the Global Portfolio Advisory Committee's (GPAC) view over a 12-month investment time horizon.

+ Overweight implies the potential for better-than-average performance for the asset class or for the region relative to other asset classes or regions.

= Market Weight implies the potential for average performance for the asset class or for the region relative to other asset classes or regions.

– Underweight implies the potential for below-average performance for the asset class or for the region relative to other asset classes or regions.

Source - RBC Wealth Management

Equities

- The S&P 500's rally that started in October 2023 could continue. Q1 earnings in the U.S. were good enough to make the consensus full-year earnings estimate look reasonable. Elsewhere, the Q1 earnings season in the UK and Europe was encouraging and led to upgrades in consensus full-year earnings forecasts.
- But new highs, fuelled in part by price-to-earnings valuations rising from already rich levels, particularly for the S&P 500, argue for a watchful approach to portfolio management. In particular, two factors, if they were to appear, would suggest a more challenging environment ahead for equity markets: a deterioration of market breadth, and an extended period of extreme bullishness on the part of investors. So far, market breadth has been improving in sync with the broad large-cap averages and market sentiment readings indicate strong optimism, but not more.
- We would hold a Market Weight position in global equities within a balanced portfolio and focus on high-quality companies with strong cash flow generation.

Fixed income

- Global bond yields remain volatile nearing the midpoint of 2024, but the average yield on the Bloomberg Global Aggregate Bond Index has steadied around 4.0% in recent months, though that remains below the 2023 peak of 4.4%. Global inflationary pressures continue to improve, but concern that progress has stalled of late has caused markets to price out near-term rate cuts. However, markets still expect modest cuts from major central banks by this summer, with the U.S. Federal Reserve following later in the year. Though yields today have dropped dramatically from the highs of late 2023, they remain well above the averages of the past 20 years and continue to present relatively attractive entry points, in our view. Still, we continue to exercise caution and patience over the near term, as yields could retrace higher until the timing and magnitude of central bank policy easing come into greater focus.
- We stay Market Weight U.S. fixed income with yields remaining above multi-decade averages. While economic risks have subsided both in the U.S. and globally, recession risks remain somewhat elevated and credit valuations are still too rich, in our view. Therefore, we broadly remain Underweight corporate credit with a slight bias toward government bonds.

MONTHLY

Focus

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Longevity: Cracking the ageing code

Emerging technological advancements are driving innovations all around us, transforming how we live, work, and interact with one another, today and in the future. RBC Wealth Management's "Innovations" series examines these agents of change and how they can open up compelling investment opportunities.

This inaugural report in the series focuses on scientific advancements related to ageing. Over the past 20 years, scientists have acquired a much fuller understanding of the biological pathways of ageing and are developing ways to slow, stall, and possibly even reverse its impact on the body and mind. We dive into a few of the most promising advances and explore the link between scientific breakthroughs and intriguing investments.

Key points

- **Living longer has exposed new health conditions unknown to past generations. Scientists' attention has turned to extending "healthspan," or the number of years a person is healthy in old age.**
- **Since the turn of the 21st century, scientists have gained greater insight into the biological mechanisms of ageing. As biological damage accumulates and remains unrepaired, age-related disorders, such as heart disease, osteoporosis, cataracts, and neurodegenerative illnesses, arise.**
- **Three approaches to tackle age-related diseases seem to hold much promise: senolytics, stem cell regeneration, and the lengthening of chromosome ends. In addition, biotech innovations in other fields which enable more efficient treatment of chronic illnesses such as cancer also play a role in expanding healthspans.**
- **The most exciting biotech innovations may not necessarily make for investments with the most promising potential upside. Investors should also assess the competitive landscape as well as the legal and regulatory environments to gauge whether a franchise is likely to be sustainable for many years.**

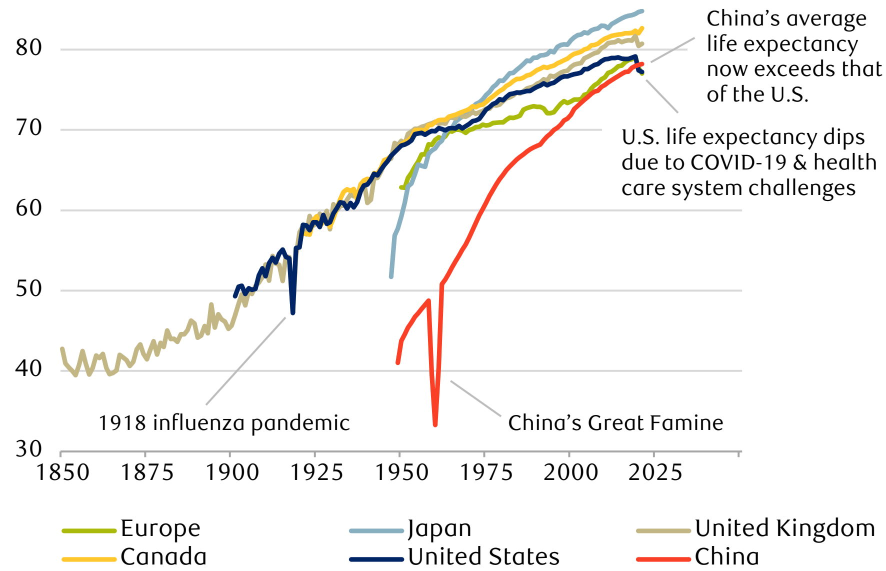
From lifespan to healthspan

Life expectancy has doubled over the past 150 years thanks to medical and social progress. Infant mortality has largely been defeated thanks to cleaner water, better nutrition, and more advances in and greater access to vaccines and antibiotics. Today, children born in developed nations can expect to have an even chance of living past their 80s.

LONGEVITY: CRACKING THE AGEING CODE

Much improvement everywhere

Life expectancy at birth since the 1850s



Source - Our World in Data

Living longer has brought with it a bevy of conditions that past generations—who were prone to die from war, accidents, famine, or epidemics—had virtually no experience with. Scientists' attention has thus turned to extending healthspan, or the number of healthy years before the end of life. Between 16 percent and 20 percent of life is spent in a state of daily battle against an increasing burden of chronic diseases in late life, according to a 2018 article in Nature, a peer-reviewed scientific publication.

Beyond the distress this causes patients and caregivers, health care costs are surging. In 2024, total U.S. health care costs for all individuals 65 years and over suffering from Alzheimer's disease will reach $360 billion, according to the Alzheimer's Association. This represents eight percent of total U.S. health care costs, or as much as cancer and cardiology combined. The Alzheimer's Association also points out that millions of family members and unpaid caregivers already provided 18.4 billion hours of care, valued at $346.6 billion in 2023.

With populations ageing, these costs will keep on rising, putting a strain on society and the economy. The global population of people 60 years and older will reach 2.1 billion by 2050, according to the World Health Organisation. No country will experience this more acutely than China, which is expected to have more than 500 million people over the age of 60 around mid-century.

Even today, the need for benefits and assistance is putting immense pressure on health care and social security systems in most ageing societies. Greater demand for these services may well require higher taxes and/or increased government debt burdens, and in turn likely push up long-term interest rates. Where a government does not or cannot provide old-age care and end-of-life services, households will likely increase their savings rate, potentially draining consumer demand.

Successfully lengthening healthspans could alleviate cost pressures on both governments and households while adding more years of satisfying life that can bring opportunities to learn and develop new skills, as well as the prospect of staying productive longer.

What is ageing?

In Ernest Hemingway's *The Sun Also Rises*, a character is asked how he went bankrupt. He answers, "Two ways. Gradually, then suddenly." The same can be said about ageing. By 60 years old, most people have at least one age-related condition. By the age of 80, most have several.

Scientists have come up with two hypotheses to explain the cause of ageing from a biological point of view. Some contend ageing is caused by the same developmental processes that are useful early on in life, only that they continue to run haphazardly into adulthood, causing the deterioration that comes with old age. For instance, the bone loss that women experience after menopause could be the continuation of the processes that drew calcium from the skeleton to produce milk in breastfeeding mothers, or far-sightedness in middle age could be caused by the lenses of the eye continuing to grow into adulthood.

Others posit that ageing is the gradual loss of the body's ability to repair itself. When it is young, the body repairs damage to ensure genes can be passed on to the next generation. But an ageing body loses the ability to repair itself efficiently, and damage starts to accumulate.

While scientists still debate the processes that drive ageing, they tend to agree on the physiological details of ageing, i.e., the cellular changes which accompany the progressive decline in physical functions over time.

In "Hallmarks of aging: An expanding universe," Carlos López-Otín, professor of biochemistry and molecular biology at the University of Oviedo in Spain, led a team that produced a widely used list of the characteristics of ageing in 2013. They recently updated it to account for the advancements in biological sciences since initial publication. Twelve "hallmarks" were identified (see table on next page) that worsen with age, accelerate if stimulated, and seem to slow down with treatment.

By dividing up the problem, it may be possible to treat each hallmark individually, thereby enhancing prospects of cracking the ageing code. In practice, many of the hallmarks are tightly intertwined, such as chronic inflammation, DNA damage, and dysfunction of the mitochondria—the powerhouses of cells—which enhances the challenge.

In a nutshell, some ageing mechanisms include:

- Genetic mutations accumulating
- Chromosome ends crumbling
- Tissue being blocked with debris
- Cells becoming cancerous while others enter a zombie-like state, harming healthy cells
- Stem cells no longer dividing and becoming unable to create new cells

- Mitochondria, the powerhouses of cells, falling into disrepair
- Chronic inflammation creeping through the body
- Gut microbiome becoming less healthy

Eventually, age-related damage exacerbates the body's vulnerabilities and can lead to chronic disorders such as heart disease, osteoporosis, cataracts, and neurodegenerative illnesses.

DIY healthspan extension (biohacking)

As the genetic pathways and biochemical processes of ageing become better understood, a culture of "do-it-yourself" healthspan extension has emerged. "Biohackers" are people who explore using existing pills and supplements in the hope of improving their healthspan, and largely operate outside the medical sphere.

It's recently become commonplace to carefully calibrate what one eats to improve the health of one's microbiome. Intermittent fasting is an increasingly popular method that aims to induce autophagy, the waste disposal system that cells use to rid themselves of damaged components. Clinics which offer blood plasma transfusion therapies to boost cell or tissue rejuvenation (i.e., epigenetic rejuvenation) are becoming more prevalent. This technique is based on findings that aged mice injected with blood from young mice experienced a reversal of biological ageing.

Hallmarks of ageing

	Definitions	Concepts
Genomic instability	A **genome** is the complete set of genetic material in an organism, and includes the DNA, genes, and chromosomes. **Genes** are often thought of as traits inherited from parents, but they primarily function as units of information. **Genomic stability** ensures the transmission of genetic material from one generation to another through a perfect replication of genetic material and a repair mechanism for any damaged replication.	Genomic instability refers to the persistent accumulation of mutations and the failure of the repair mechanism to correct them. For instance, mutations that enable cells to reproduce unbridled can cause cancer. Cells can only reproduce or undergo division 40–60 times (except stem cells and cancer cells).
Telomere attrition	**Telomeres** are protective caps found at the ends of chromosomes. They help protect the genome, the genetic material, and help guard cells against mutations. Telomeres shorten every time cells divide.	The shortening of telomeres limits the number of future cell divisions, ultimately causing the number of healthy cells to decline.
Epigenetic alterations	**Epigenetic markers** are labels, akin to bar codes, located at specific sites on chromosomes, which tell cells what genes to use.	Changes in epigenetic markers can affect gene function. For instance, alterations can change the pattern of gene expression in a way that may encourage the development of cancers.
Loss of proteostatis	**Proteostatis** is the process that ensures a cell is supplied with the right proteins in perfect condition and in the right proportions.	Loss of proteostatis leads to cells producing proteins in imperfect forms and inappropriate numbers. Accumulations of imperfect proteins seem to be the cause of several diseases of old age, such as Alzheimer's or cataracts.
Disabled autophagy	**Autophagy** is the process of waste disposal that cells use to eliminate their damaged components.	When autophagy mechanisms fail, debris accumulates.

Continued on next page

LONGEVITY: CRACKING THE AGEING CODE

However, evidence of the success of this method as applied to humans remains inconclusive.

Many scientists are concerned there is too much hype around biohacking and its unconventional approaches.

Most promise

In his recently published book *Why We Die: The New Science of Aging and the Quest for Immortality*, Venki Ramakrishnan, a molecular biologist and co-winner of the 2009 Nobel Prize in Chemistry, highlights three approaches which he judges as most promising:

- **Senolytics**

This class of drugs is designed to target senescent cells—those that have ceased dividing. Non-cancerous cells reproduce themselves 40–60 times, after which cell division stops. The cells do not die but rather enter a zombie-like state called senescence. A young body clears out these decrepit cells by either triggering a self-destruction process or by using the immune system to kill them off. But both of these natural clearing-out processes become less efficient with age.

Hallmarks of ageing (continued)

	Definitions	Concepts
Deregulated nutrient sensing	**Deregulated nutrient sensing** refers to deterioration in the cell's ability to sense nutrients.	Deregulated nutrient sensing disrupts the cell's ability to regulate its energy metabolism.
Mitochondrial dysfunction	**Mitochondria** are the powerhouses of cells, responsible for respiration and energy production.	Dysfunctional mitochondria become less efficient at producing energy.
Cellular senescence	**Senescent cells** are those that no longer divide but continue to live on in a zombie-like state instead of self-destructing. Proteins are usually considered an essential part of diet, but they also give the body form and strength and carry out most of the chemical reactions essential for life.	Senescent cells can cause damage to nearby healthy cells by pumping out inflammatory proteins that destroy healthy tissue around them.
Stem cell exhaustion	**Stem cells** are the reserves from which new cells can be produced and regenerate tissue. They are particular in that they continuously divide—unlike other non-cancerous cells, which only divide 40–60 times.	When stem cells stop dividing, they are unable to generate new cells to replace the old ones.
Altered intercellular communication	**Intercellular communication** takes place when cells communicate with one another to enable an individual to function.	The systems used by cells to coordinate their actions start to unravel and eventually stop working.
Chronic inflammation	**Inflammation** is the body's process of fighting against things that harm it, like infections, injuries, and toxins. Cells suffering from genetic instability or senescence can also start this process, causing chronic inflammation.	By starting the process to fight perceived harm, cells provoke inflammatory responses, but as there is no infection to fight, the response causes problems.
Dysbiosis	**Dysbiosis** is the disruption of the microbiome, or the collection of bacteria, fungi, and other microbes that live in the gut.	As the microbiome becomes less healthy, the communications between its microbes and the body go wrong.

Source - Carlos López-Otín et al., "Hallmarks of aging: An expanding universe," *Cell* 186, no. 2 (Jan. 3, 2023); Venki Ramakrishnan, *Why We Die: The New Science of Aging and the Quest for Immortality* (Stoughton, 2024)

Senescent cells which accumulate in the body secrete inflammatory molecules, dripping destructive compounds into nearby tissue and inhibiting the proper functioning of healthy cells in close proximity. Science suggests that senescent cells are at the root of many ageing-related diseases, including cancer, atherosclerosis, osteoarthritis, osteoporosis, Parkinson's, Alzheimer's, and cataracts.

As a first step, scientists are focusing on drugs and supplements already approved for human use for different indications to try and see if they can clear out senescent cells. There are as many as 20 ongoing clinical trials on humans, according to an August 2022 article in Nature Medicine.

- **Stem cell regeneration and cellular reprogramming**

Another approach focuses on rejuvenating or reprogramming the cells, capitalizing on recent developments in stem cell science. Stem cells are the reserves from which new cells can be produced to regenerate tissue, and are already widely used in regenerative medicine. Many scientists are searching for applications in the hope of countering ageing.

Researchers are seeking to reprogram cells so as to try and revert them to an earlier stage capable of regeneration. Blood stem cell transplants have been found to extend the life of mice by 20 percent.

- **Telomerase reactivation**

Telomeres are segments of DNA at the end of each chromosome. Every time a cell copies its chromosomes and divides, telomeres become slightly shorter. When telomeres get too short or wear out completely, cells may stop dividing and become senescent.

Scientists are focusing on reactivating telomeres, to prevent them from shortening as cells divide. An enzyme, telomerase, has been discovered that can lengthen telomeres. This enzyme is usually only active in cells, such as stem cells, that divide a very large number of times, unlike normal cells. As the body deactivates telomerase as part of the ageing process, scientists are exploring whether it is possible to reactivate it in an effort to prevent the shortening of telomeres.

Good things come to those who wait

While Ramakrishnan is optimistic about these cutting-edge methods of combating ageing, it could take at least a couple of decades to create the necessary and successful therapeutics, in his view. The vast majority of experimental drugs that prove successful in labs and on mice or other animals fail once applied to humans—and even those that work very rarely make it to market.

In the meantime, RBC Capital Markets, LLC Senior Biotechnology Research Analyst Luca Issi points out that healthspan can be materially expanded via better diagnostics, earlier intervention, and improved therapies for diseases such as cancer and heart disease.

Moreover, he asserts that biotech innovations in fields beyond ageing have flourished, enabling more efficient treatment of several conditions. For instance, multiple drugs have been approved in the area of genetic medicine, which focuses on individual genes that cause diseases and manipulates them to make an impact for patients. So far, approvals have mostly been given to treatments for rare diseases such as spinal muscular atrophy and beta-thalassemia, an inherited blood disorder. But as the technology advances, approvals for treatments of more common illnesses, such as cancer, cardiovascular disease, or eye disease, are around the corner, in his view.

A good investment?

Investing in the "combating ageing" theme can be implemented via the biotech industry. Still, Issi points out that the most exciting biotech innovations may not necessarily translate into the most promising investments. Those companies that can successfully prioritize diseases with a meaningful unmet need and potentially large patient population, and execute on well-designed clinical trials are more likely to emerge as winners, in Issi's assessment.

He believes investors should also monitor the competitive landscape to evaluate whether a franchise is likely to be sustainable for many years. Assessing other secular changes and disruptive forces, such as technologies or legal and regulatory environments that would potentially have a transformational impact on the value of both existing and emerging biotech franchises, is also key to gauge whether investments are promising.

Other industries may experience shifts in demand as the population ages and play into the theme as well:

- Wealth management may well find it has a captive audience as individuals will need to consider how not to outlive their savings.
- Homebuilders in various geographies may experience changing demand for residential space, if the experience in Japan is anything to go by. The Japan Times reported in May 2024 that there are nine million vacant homes in the country, largely the result of ageing. Housing demand to accommodate multi-generational households may rise in some regions, while others may see growing demand for single-occupancy homes.
- The ongoing revolution in biological sciences may also boost demand for life science real estate (i.e., lab and office space for tenants involved in scientific discoveries).

So close, yet so far

With scientists having clearer insight into the biological pathways of ageing, the prospects for positive healthspan outcomes appear more promising than 20 years ago thanks to a proliferation of effort including hundreds of companies exploring dozens of different compounds, and human clinical trials that are underway. Medical breakthroughs are possible, as the recent drugs targeting obesity—a condition which eluded treatment for decades—have demonstrated.

In the meantime, a good diet, exercise, and sound sleep seem to be the best strategy for those aspiring for a long and healthy life.

GLOBAL

Equity

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Firm footing—for now

As 2024 began, we expected the major global stock market averages would soon move into new all-time high ground. Between early January and April, all mostly did with the China and Hong Kong markets the notable exceptions. Eventually even the laggard small-cap indexes began to advance on a trend basis.

Our confidence was bolstered by supportive "breadth" readings indicating that most stocks were trending higher, in sync with the broad large-cap indexes. That was especially true for the bellwether S&P 500.

[The term "market breadth" refers to measures that try to indicate whether the market trend is being determined by a "broad" majority of stocks moving in the same direction or by a "narrow" selection of heavily weighted favorites. The two breadth measures most commonly referred to are the advance-decline line and the unweighted index.]

Expanding breadth is an important indication that a market advance is on a firm footing. The solid uptrends traced out by advance-decline lines and unweighted averages, if they were to continue, would strongly suggest to us the broad stock market advance that kicked off in October 2023 could have further to run.

However, there are two factors which, if they were to appear, would suggest a more challenging environment ahead for equity markets. The most important would be a negative de-coupling of breadth readings from the upward path of the market. In other words, breadth measures roll over and head lower even as the capitalization-weighted indexes such as the S&P 500 continue to move higher. So far, no such negative divergence has appeared.

The second would be an extended period of extreme bullishness / complacency on the part of investors.

Equity views

Region	Current
Global	=
United States	=
Canada	=
Continental Europe	=
United Kingdom	–
Asia (ex Japan)	=
Japan	+

+ Overweight; = Market Weight; – Underweight
Source - RBC Wealth Management

While market sentiment readings indicate investors are a lot more optimistic than they were at the October 2023 lows, they are still not fully into the ultra-bullish territory which had, in the past, signaled the approaching end of major market uplegs. Moreover, sentiment is often weeks or months at or near those very elevated levels before the market succumbs.

However, while sentiment may not yet be over the top, investors seem willing to ignore the fact that stock valuations overall are no longer compelling. To be clear, valuation is a poor timing tool because stocks can always move far enough to become cheaper or more expensive than seems reasonable to investors or can be justified by either arithmetic or history. However, in this case, we would say the very big changes in the U.S. stock market valuation over the past 18 months should be acknowledged.

In late October 2022, at the bottom of what had been a painful 10-month market correction, the S&P 500, at 3500, was trading at just 16x the last 12-month earnings of about $217 per share. Despite heavily marked-down prices, buyers were hard to find; gauges of investor sentiment were deeply pessimistic.

GLOBAL EQUITY

Now, 20 months later, S&P 500 earnings per share are up a paltry 4%, but the index is ahead by a rip-roaring 51%, trading at a much-richer 23.4x last 12-month earnings. Investors seem to be attracted by rising prices and rich valuation as much as they were put off in the fall of 2022 by bargain prices. And interest rates are not the explanation: as things stand today, the 10-year Treasury bond is yielding modestly more than it was 20 months ago while the fed funds rate is almost 250 basis points higher than it was. If anything, higher rates argue for lower price-to-earnings ratios, not higher.

It would seem investors must be confident about the outlook for future earnings. Consensus projections are for S&P earnings to rise by 11% to $244 this year from $220 in 2023. That would put the market at 21.6x this year's earnings, still rich enough that any setback for earnings expectations might not be greeted gracefully by investors.

If the bullish earnings outlook is more or less borne out by actual results, it could be enough to keep this market moving higher, especially if a Fed rate cut continues to look like the most plausible next step for monetary policy.

We are paying close attention to market breadth and sentiment for any signs that a more defensive posture should be considered. Until then, in our assessment, a watchful commitment to equities in a global balanced portfolio is called for.

GLOBAL
Fixed income

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Disinflation disappointment

The significant disinflationary progress made since global inflationary pressures peaked in 2022, and which gained steam at the end of 2023, appears to have stalled out.

And with disinflationary impulses fading, so too have expectations for central bank rate cuts this year. Traders who, early in 2024, had looked for major central banks to deliver somewhere between five and seven rate cuts, now see policymakers only cutting rates about one to three times, depending on the region.

The Federal Reserve has already conceded that the lack of further progress is likely to delay any rate cut plans. The clock has essentially been reset for policymakers who have been looking for a string of improving inflation data to "gain confidence" that inflation remains on track back to 2%.

That said, U.S. inflation data released in May for the month of April eased some of the market's recent fears. While the numbers remained higher than levels consistent with the Fed's goal, the simple fact that there wasn't an upside surprise relative to expectations was a welcomed change after a series of disappointments to start the year. We see scope for inflation data to continue to come in soft, but recent increases in global shipping costs and a still-robust U.S. economy could keep risks of further disappointments slightly elevated. To be sure, though inflation data hasn't improved as much as hoped, we still see minimal prospects of a material reacceleration in prices.

So, while it's feasible that a run of favorable inflation data over the course of the summer could tee up a September rate cut from the Fed, our base case remains for a first cut in December.

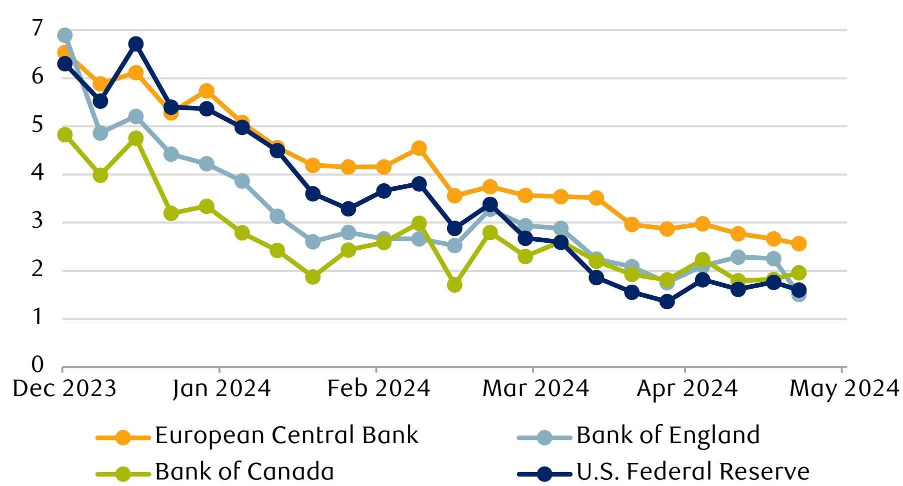
Fixed income views

Region	Gov't bonds	Corp. credit	Duration
United States	+	–	3–7
Canada	+	=	3–7
Continental Europe	+	=	3–7
United Kingdom	+	–	3–7

+ Overweight; = Market Weight; – Underweight
Source - RBC Wealth Management

2024 rate cut prospects continue to slip away

Market expectations for number of rate cuts by each central bank

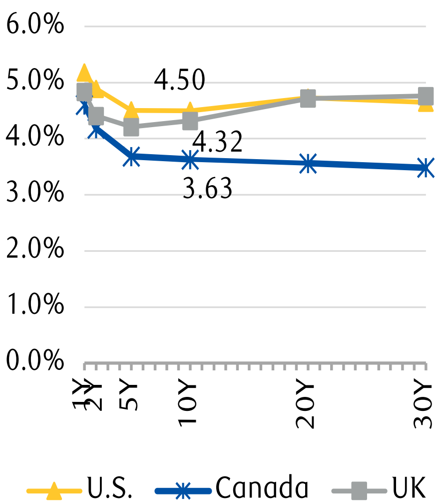


Source - RBC Wealth Management, Bloomberg

A similar narrative appears to have also knocked the Bank of England off course from a rate cut as early as this summer. Inflation data for April showed service sector prices—a key gauge of underlying inflation trends—rising 5.9% y/y compared to Bloomberg consensus expectations of 5.4% y/y. Markets are now looking for a first rate cut later in the year.

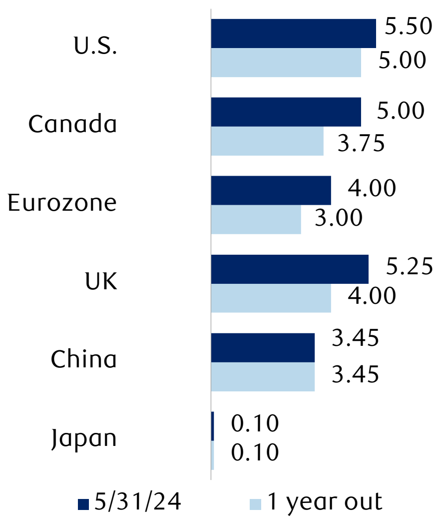
The European Central Bank and the Bank of Canada remain on track to deliver both the first and likely greatest number of rate cuts this year. Inflation data in Canada has continued to improve, but it has come at the expense of disappointing economic growth. We expect both central banks to deliver rate cuts this month.

Sovereign yield curves



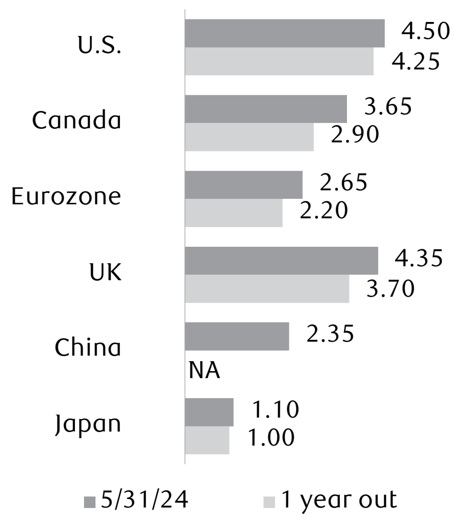
Source - Bloomberg; data through 5/31/24

Central bank rates (%)



Source - RBC Investment Strategy Committee, RBC Capital Markets forecasts, Global Portfolio Advisory Committee, RBC Global Asset Management

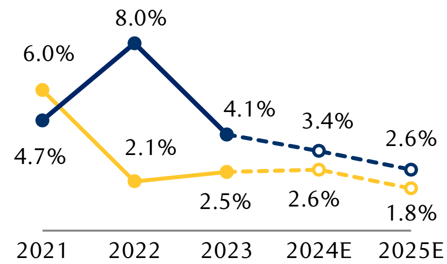
10-year rates (%)



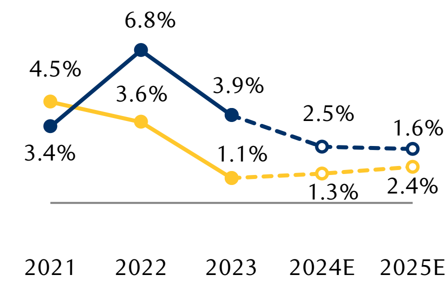
Note: Eurozone utilizes German Bunds.
Source - RBC Investment Strategy Committee, Global Portfolio Advisory Committee, RBC Global Asset Management

KEY
Forecasts

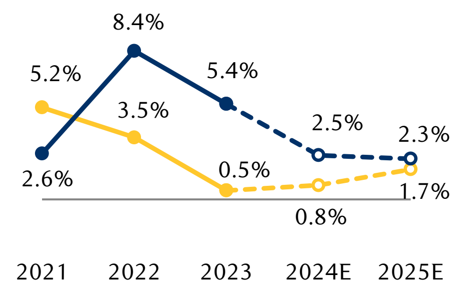
United States



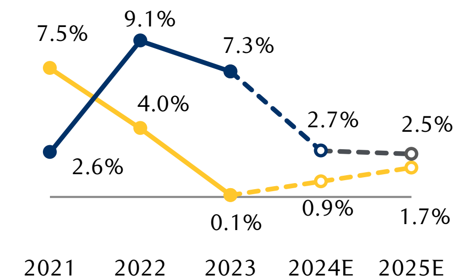
Canada



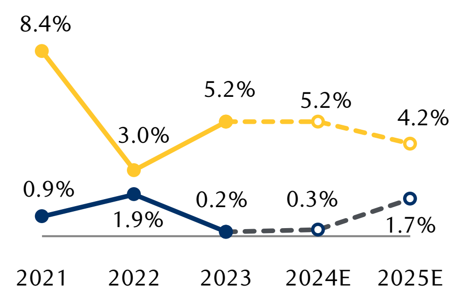
Eurozone



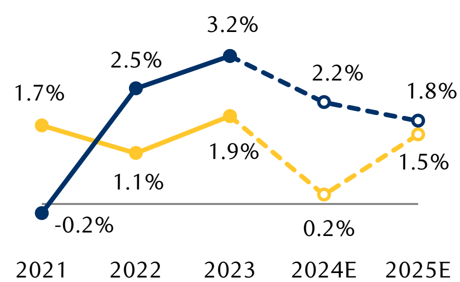
United Kingdom



China



Japan



Real GDP growth

Inflation rate

Source - RBC Investment Strategy Committee, RBC Capital Markets, Global Portfolio Advisory Committee, RBC Global Asset Management, Bloomberg consensus estimates

Research resources

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As of March 31, 2024

			Investment Banking Services Provided During Past 12 Months	
Rating	Count	Percent	Count	Percent
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Hold [Sector Perform]	585	40.01	151	25.81
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Wealth Management

Canadian, US and Financial market forecast tables

March 2024

Economic forecast detail — Canada

Real growth in the economy

Quarter-over-quarter annualized % change unless otherwise indicated

	2023				Forecast 2024				2025						Forecast	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	2022	2023	2024F	2025F
Household Consumption	4.1	-0.7	0.5	1.0	0.0	0.4	1.8	2.2	2.0	2.2	2.6	2.6	5.1	1.7	0.6	2.1
Durables	3.8	-3.0	4.2	7.0	0.5	1.3	2.0	3.0	2.2	2.5	2.0	2.5	-1.8	2.3	2.4	2.3
Semi-Durables	15.1	-0.9	-12.7	0.5	0.0	0.5	1.0	2.0	2.0	2.2	2.0	2.7	7.5	1.8	-1.3	1.9
Non-durables	-1.4	2.2	-1.7	-0.7	0.0	0.9	1.5	2.0	2.0	2.2	3.2	2.6	-0.3	-0.5	0.3	2.1
Services	5.3	-1.4	2.4	0.4	-0.1	0.0	1.9	2.2	2.0	2.2	2.6	2.7	9.1	2.6	0.6	2.1
NPISH consumption	-2.4	2.7	5.0	3.4	0.0	0.4	1.8	2.2	2.0	2.2	2.6	2.6	5.1	1.7	1.9	2.1
Government expenditures	1.0	0.4	6.7	-1.9	1.5	5.0	2.7	3.3	4.0	2.0	3.6	4.0	3.2	1.5	2.3	3.3
Government fixed investment	18.8	-4.6	2.4	3.2	1.5	2.0	1.0	2.0	2.6	2.6	2.8	2.6	4.2	5.5	1.6	2.3
Residential investment	-14.0	-3.5	8.7	-1.7	2.0	3.0	2.0	3.0	3.9	4.0	4.2	5.0	-12.1	-10.2	2.0	3.6
Non-residential investment	1.8	15.0	-16.3	-9.5	-1.9	2.0	2.5	3.1	4.0	4.3	4.0	4.3	4.0	-0.7	-2.8	3.6
Non-residential structures	3.4	10.6	-14.3	-11.6	-3.0	2.0	3.0	3.2	4.6	5.6	5.0	5.0	6.7	2.6	-3.4	4.2
Machinery & equipment	-0.8	23.3	-19.8	-5.7	0.0	2.0	1.5	3.0	3.0	2.0	2.3	3.0	-0.3	-6.2	-1.8	2.5
Intellectual property	7.9	-8.9	-3.7	-0.6	2.0	0.0	2.1	2.2	2.8	3.2	3.6	4.0	6.0	-0.5	-0.3	2.6
Final domestic demand	2.2	0.4	0.8	-0.7	0.4	1.8	2.0	2.6	2.8	2.5	3.1	3.3	2.8	0.5	0.8	2.6
Exports	14.1	4.3	-1.3	5.6	2.0	1.9	2.0	1.8	3.0	3.0	2.0	2.0	3.2	5.7	2.4	2.4
Imports	3.7	4.6	1.1	-1.7	6.5	2.0	2.5	3.0	2.0	3.0	4.0	2.6	7.6	1.0	2.6	2.7
Inventories (change in $b)	34.6	35.5	33.3	32.0	39.8	37.5	37.0	37.0	30.0	27.6	28.5	27.5	55.3	33.9	37.8	28.4
Real gross domestic product	**2.6**	**0.6**	**-0.5**	**1.0**	**0.3**	**1.4**	**1.8**	**2.2**	**2.0**	**2.1**	**2.6**	**2.9**	**3.8**	**1.1**	**0.8**	**2.1**

Other indicators

Year-over-year % change unless otherwise indicated

	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	2022	2023	2024F	2025F
Business and labour																
Productivity	-1.9	-1.8	-1.8	-0.5	-0.2	-0.1	0.3	0.0	0.3	0.3	0.5	0.6	-0.8	-1.5	0.0	0.4
Pre-tax corporate profits	-13.0	-27.0	-21.5	-9.7	1.2	10.6	6.6	3.4	4.2	3.4	2.7	2.9	14.7	-18.1	5.3	3.3
Unemployment rate (%)*	5.1	5.3	5.5	5.8	5.8	6.2	6.5	6.5	6.4	6.4	6.3	6.2	5.3	5.4	6.3	6.3
Inflation																
Headline CPI	5.1	3.5	3.7	3.2	3.0	2.8	2.2	2.0	2.0	1.9	1.9	1.8	6.8	3.9	2.5	1.9
CPI ex. food and energy	4.8	4.0	3.4	3.4	3.1	2.8	2.6	2.1	2.0	1.9	1.9	1.8	5.0	3.9	2.7	1.9
External trade																
Current account balance ($b)*	-18.6	-27.0	-19.0	-6.5	-22.0	-16.6	-14.3	-12.7	-14.0	-12.3	-17.7	-14.3	-10.3	-17.8	-16.4	-14.5
% of GDP*	-0.7	-0.9	-0.7	-0.2	-0.7	-0.6	-0.5	-0.4	-0.5	-0.4	-0.6	-0.4	-0.4	-0.6	-0.6	-0.5
Housing starts (000s)*	221	246	256	244	236	245	248	250	261	274	283	288	262	240	244	277
Motor vehicle sales (mill., saar)*	1.67	1.71	1.74	1.84	1.84	1.85	1.86	1.87	1.88	1.90	1.90	1.92	1.56	1.74	1.86	1.90

*Period average
Source: Statistics Canada, RBC Economics

Economic forecast detail — United States

Real growth in the economy

Quarter-over-quarter annualized % change unless otherwise indicated

	2023				Forecast 2024				2025						Forecast	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	2022	2023	2024F	2025F
Consumer spending	3.8	0.8	3.1	3.0	1.9	0.0	1.4	1.3	1.7	2.1	1.8	2.0	2.5	2.2	1.7	1.6
Durables	14.0	-0.3	6.7	3.2	2.1	0.2	0.8	2.0	1.9	2.0	1.0	2.0	-0.3	4.2	2.2	1.6
Non-durables	0.5	0.9	3.9	3.3	2.0	0.1	1.5	1.2	2.4	2.0	1.6	2.1	0.6	0.9	1.9	1.7
Services	3.1	1.0	2.2	2.8	1.9	0.0	1.5	1.2	1.4	2.2	2.0	1.9	3.7	2.3	1.6	1.5
Government spending	4.8	3.3	5.8	4.2	2.0	1.5	2.0	2.0	1.8	1.5	1.0	2.0	-0.9	4.0	2.9	1.7
Residential investment	-5.3	-2.2	6.7	2.9	2.8	-0.5	1.0	1.1	3.0	3.1	3.2	3.2	-9.0	-10.6	2.0	2.2
Non-residential investment	5.7	7.4	1.5	2.4	-1.3	-0.3	0.9	2.0	2.6	2.8	2.7	3.0	5.2	4.4	0.9	2.2
Non-residential structures	30.3	16.1	11.2	7.6	-0.5	-1.0	1.0	2.5	3.0	2.0	3.2	3.0	-2.1	13.0	3.6	2.2
Equipment & software	-4.1	7.7	-4.4	-1.7	0.0	0.0	1.0	2.0	3.0	1.0	2.0	4.2	5.2	-0.3	-0.2	1.9
Intellectual property	3.8	2.7	1.8	3.3	-3.0	-0.2	0.8	1.5	2.0	4.8	3.0	4.0	9.1	4.4	0.4	2.4
Final domestic demand	3.8	2.0	3.5	3.1	1.6	0.3	1.5	1.5	1.9	2.1	1.8	2.3	1.7	2.2	1.8	1.7
Exports	6.8	-9.3	5.4	6.4	4.6	3.1	2.0	1.0	2.0	1.0	1.5	0.8	7.0	2.7	3.3	1.6
Imports	1.3	-7.6	4.2	2.7	2.2	-1.0	4.0	3.6	2.5	4.0	3.0	4.0	8.6	-1.6	1.6	3.1
Inventories (change in $b)	27.2	14.9	77.8	66.3	79.0	72.0	60.0	59.0	55.0	55.0	63.0	55.0	128.1	46.6	67.5	57.0
Real gross domestic product	**2.2**	**2.1**	**4.9**	**3.2**	**2.0**	**0.5**	**1.0**	**1.2**	**1.8**	**1.8**	**1.8**	**1.8**	**1.9**	**2.5**	**2.1**	**1.5**

Other indicators

Year-over-year % change unless otherwise indicated

	2023 Q1	2023 Q2	2023 Q3	2023 Q4	2024 Q1	2024 Q2	2024 Q3	2024 Q4	2025 Q1	2025 Q2	2025 Q3	2025 Q4	2022	2023	2024F	2025F
Business and labour																
Productivity	-0.5	1.2	2.4	2.7	2.9	2.0	0.9	0.2	0.4	0.8	0.9	1.1	-1.9	1.5	1.5	0.8
Pre-tax corporate profits	4.6	-2.7	-0.6	2.3	5.7	5.4	2.1	0.9	0.8	1.3	1.8	2.1	9.8	0.8	3.5	1.5
Unemployment rate (%)*	3.5	3.6	3.7	3.7	3.8	4.1	4.2	4.3	4.3	4.2	4.2	4.2	3.7	3.6	4.1	4.2
Inflation																
Headline CPI	5.8	4.0	3.5	3.2	3.1	3.0	2.8	2.7	2.3	2.2	2.1	2.1	8.0	4.1	2.9	2.2
CPI ex. food and energy	5.6	5.2	4.4	4.0	3.7	3.2	3.0	2.8	2.4	2.3	2.3	2.3	6.2	4.8	3.2	2.3
External trade																
Current account balance ($b)*	-857.9	-867.2	-801.2	-797.1	-781.6	-757.0	-780.1	-807.1	-813.1	-841.3	-857.3	-889.7	-971.6	-830.9	-781.5	-850.4
% of GDP*	-3.2	-3.2	-2.9	-2.9	-2.8	-2.7	-2.7	-2.8	-2.8	-2.9	-2.9	-3.0	-3.8	-3.0	-2.7	-2.9
Housing starts (000s)*	1385	1450	1371	1483	1373	1383	1395	1410	1421	1433	1446	1458	1551	1422	1390	1440
Motor vehicle sales (millions, saar)*	15.0	15.8	15.7	15.7	15.5	15.5	15.7	16.0	14.2	14.5	14.6	14.9	13.8	15.5	15.7	14.5

*Period average

Source: Bureau of Economic Analysis, RBC Economics

Financial market forecast detail

Interest rates—North America

%, end of period

					Forecast									Forecast	
	23Q1	23Q2	23Q3	23Q4	24Q1	24Q2	24Q3	24Q4	25Q1	25Q2	25Q3	25Q4	2023	2024F	2025F
Canada															
Overnight	4.50	4.75	5.00	5.00	5.00	4.75	4.25	4.00	3.75	3.25	3.00	3.00	5.00	4.00	3.00
Three-month	4.34	4.90	5.07	5.04	4.95	4.65	4.10	3.95	3.60	3.20	3.00	3.00	5.04	3.95	3.00
Two-year	3.74	4.58	4.87	3.88	4.20	3.80	3.50	3.25	2.90	2.75	2.90	3.00	3.88	3.25	3.00
Five-year	3.02	3.68	4.25	3.17	3.45	3.30	3.10	3.00	2.85	2.90	2.90	3.00	3.17	3.00	3.00
10-year	2.90	3.26	4.03	3.10	3.40	3.25	3.10	3.00	2.90	2.95	3.00	3.10	3.10	3.00	3.10
30-year	3.02	3.09	3.81	3.02	3.35	3.25	3.15	3.05	3.00	3.05	3.10	3.15	3.02	3.05	3.15
Yield curve (10s-2s)	-84	-132	-84	-78	-80	-55	-40	-25	0	20	10	10	-78	-25	10.00
United States															
Fed funds*	4.88	5.13	5.38	5.38	5.38	5.13	4.88	4.63	4.63	4.38	4.38	4.13	5.38	4.63	4.13
Three-month	4.85	5.43	5.55	5.40	5.33	5.01	4.78	4.53	4.58	4.33	4.33	4.08	5.40	4.53	4.08
Two-year	4.06	4.87	5.03	4.23	4.60	4.50	4.35	4.30	4.25	4.20	4.20	4.25	4.23	4.30	4.25
Five-year	3.60	4.13	4.60	3.84	4.15	4.05	3.95	3.95	3.95	4.00	4.10	4.20	3.84	3.95	4.20
10-year	3.48	3.81	4.59	3.88	4.15	4.05	3.95	4.00	4.05	4.10	4.20	4.30	3.88	4.00	4.30
30-year	3.67	3.85	4.73	4.03	4.30	4.20	4.15	4.20	4.25	4.30	4.35	4.40	4.03	4.20	4.40
Yield curve (10s-2s)	-58	-106	-44	-35	-45	-45	-40	-30	-20	-10	0	5	-35	-30	5
Yield spreads															
Three-month T-bills	-0.51	-0.53	-0.48	-0.36	-0.38	-0.36	-0.68	-0.58	-0.98	-1.13	-1.33	-1.08	-0.36	-0.58	-1.08
Two-year	-0.32	-0.29	-0.16	-0.35	-0.40	-0.70	-0.85	-1.05	-1.35	-1.45	-1.30	-1.25	-0.35	-1.05	-1.25
Five-year	-0.58	-0.45	-0.35	-0.67	-0.70	-0.75	-0.85	-0.95	-1.10	-1.10	-1.20	-1.20	-0.67	-0.95	-1.20
10-year	-0.58	-0.55	-0.56	-0.78	-0.75	-0.80	-0.85	-1.00	-1.15	-1.15	-1.20	-1.20	-0.78	-1.00	-1.20
30-year	-0.65	-0.76	-0.92	-1.01	-0.95	-0.95	-1.00	-1.15	-1.25	-1.25	-1.25	-1.25	-1.01	-1.15	-1.25

Note: Interest Rates are end of period rates. * Midpoint of 25 basis point range

Interest rates—International

%, end of period

					Forecast									Forecast	
	23Q1	23Q2	23Q3	23Q4	24Q1	24Q2	24Q3	24Q4	25Q1	25Q2	25Q3	25Q4	2023F	2024F	2025F
United Kingdom															
Bank Rate	4.25	5.00	5.25	5.25	5.25	5.25	4.75	4.25	4.00	3.75	3.75	3.75	5.25	4.25	3.75
Two-year	3.42	5.27	4.91	3.98	4.50	4.40	4.30	4.15	4.00	3.90	4.00	4.00	3.98	4.15	4.00
Five-year	3.33	4.66	4.53	3.46	4.00	3.90	3.80	3.60	3.50	3.55	3.60	3.65	3.46	3.60	3.65
10-year	3.47	4.39	4.46	3.54	4.10	4.00	3.90	3.75	3.70	3.75	3.85	3.95	3.54	3.75	3.95
30-year	3.82	4.42	4.92	4.14	4.75	4.70	4.60	4.50	4.50	4.60	4.70	4.85	4.14	4.50	4.85
Euro Area															
Deposit rate	3.00	3.50	4.00	4.00	4.00	3.75	3.50	3.25	3.00	2.75	2.50	2.50	4.00	3.25	2.50
Two-year	2.66	3.27	3.20	2.40	2.75	2.70	2.70	2.60	2.50	2.40	2.30	2.30	2.40	2.60	2.30
Five-year	2.30	2.58	2.79	1.94	2.50	2.40	2.30	2.20	2.15	2.20	2.20	2.25	1.94	2.20	2.25
10-year	2.28	2.39	2.85	2.03	2.55	2.40	2.35	2.20	2.20	2.20	2.25	2.30	2.03	2.20	2.30
30-year	2.35	2.38	3.05	2.27	2.70	2.60	2.50	2.50	2.50	2.50	2.60	2.70	2.27	2.50	2.70
Australia															
Cash target rate	3.60	4.10	4.10	4.35	4.35	4.35	4.35	3.85	3.35	3.35	3.35	3.35	4.35	3.85	3.35
Two-year	2.96	4.21	4.09	3.71	3.70	3.65	3.50	3.40	3.40	3.40	3.60	3.75	3.71	3.40	3.75
10-year	3.30	4.02	4.49	3.95	4.30	4.25	4.10	4.00	3.95	3.95	4.00	4.25	3.95	4.00	4.25
New Zealand															
Cash target rate	4.75	5.50	5.50	5.50	5.50	5.50	5.00	4.50	4.00	4.00	4.00	4.00	5.50	4.50	4.00
Two-year	5.01	5.46	5.69	4.63	5.00	4.75	4.40	4.25	4.25	4.25	4.30	4.35	4.63	4.25	4.35
10-year	4.27	4.46	5.13	4.12	4.50	4.40	4.30	4.25	4.30	4.45	4.50	4.60	4.12	4.25	4.60

Outlook

Growth outlook
% change, quarter-over-quarter in real GDP

Growth outlook
% change, quarter-over-quarter in real GDP

	23Q1	23Q2	23Q3	23Q4	24Q1	24Q2	24Q3	24Q4	25Q1	25Q2	25Q3	25Q4	2022	2023	2024F	2025F
Canada*	2.6	0.6	-0.5	1.0	0.3	1.4	1.8	2.2	2.0	2.1	2.6	2.9	3.8	1.1	0.8	2.1
United States*	2.2	2.1	4.9	3.2	2.0	0.5	1.0	1.2	1.8	1.8	1.8	1.8	1.9	2.5	2.1	1.5
United Kingdom	0.2	0.0	-0.1	-0.3	0.0	0.1	0.2	0.2	0.3	0.3	0.3	0.3	4.3	0.1	0.0	1.1
Euro Area	0.0	0.1	-0.1	0.0	0.0	0.1	0.2	0.3	0.3	0.4	0.4	0.4	3.5	0.5	0.2	1.2
Australia	0.6	0.5	0.3	0.2	0.3	0.6	0.9	0.7	0.8	0.8	0.8	0.7	3.8	2.1	1.6	3.1

*Seasonally adjusted annualized rates

Inflation outlook
% change, year-over-year

	23Q1	23Q2	23Q3	23Q4	24Q1	24Q2	24Q3	24Q4	25Q1	25Q2	25Q3	25Q4	2022	2023	2024F	2025F
Canada	5.1	3.5	3.7	3.2	3.0	2.8	2.2	2.0	2.0	1.9	1.9	1.8	6.8	3.9	2.5	1.9
United States	5.8	4.0	3.5	3.2	3.1	3.0	2.8	2.7	2.3	2.2	2.1	2.1	8.0	4.1	2.9	2.2
United Kingdom	10.2	8.4	6.7	4.2	4.3	2.8	2.9	2.7	2.2	1.7	1.9	1.8	9.1	7.3	3.2	1.9
Euro Area	8.0	6.2	5.0	2.7	2.6	2.5	2.1	2.3	2.2	2.1	2.1	2.1	8.4	5.4	2.4	2.1
Australia	7.0	6.0	5.4	4.1	3.5	3.4	2.9	3.1	3.0	2.9	2.9	2.8	6.6	5.6	3.2	2.9

Exchange rates
End of period

					Forecast									Forecast	
	23Q1	23Q2	23Q3	23Q4	24Q1	24Q2	24Q3	24Q4	25Q1	25Q2	25Q3	25Q4	2023	2024F	2025F
AUD/USD	0.67	0.67	0.65	0.68	0.65	0.64	0.65	0.66	0.68	0.70	0.71	0.73	0.68	0.66	0.68
USD/CAD	1.35	1.32	1.35	1.32	1.34	1.36	1.33	1.31	1.31	1.30	1.30	1.29	1.32	1.31	1.31
EUR/USD	1.09	1.09	1.06	1.11	1.08	1.06	1.06	1.08	1.10	1.12	1.15	1.18	1.11	1.08	1.10
USD/JPY	133	144	149	141	145	145	150	150	146	141	138	135	141	150	146
USD/CHF	0.92	0.90	0.92	0.84	0.89	0.92	0.94	0.94	0.95	0.95	0.94	0.93	0.84	0.94	0.95
GBP/USD	1.24	1.27	1.22	1.27	1.27	1.25	1.23	1.24	1.24	1.23	1.24	1.26	1.27	1.24	1.24

Note: Exchange rates are expressed in units per USD, with the exception of the euro, GBP and AUD which are expressed in USD per local currency unit.
Source: Reuters, RBC Economics forecasts

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Economics

ECONOMIC INSIGHTS

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The neutral rate: Why one size doesn't fit all

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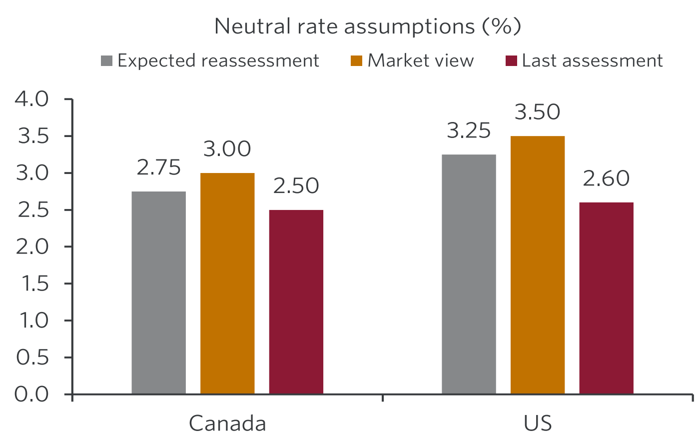
American Justice Potter Stuart opined that while he couldn't define pornography that could legally be barred, "I know it when I see it". That quote might just as easily apply to what economists call the neutral rate of interest, the policy rate that will keep the economy at potential output and stable inflation in the absence any shocks.

The Bank of Canada is due to update its estimate for the neutral rate in its April policy report, and we expect them to raise their point estimate by 25bps to 2.75%, which would still be a bit below what markets are now assuming (Chart 1). The Fed only just nudged up its estimate for the US neutral rate by 10 bps to 2.6%, even though we see it as eventually bringing their long run "dot" to a little over 3%, which is where the 2026 dot sits. But for either the Fed or the Bank, there's really no pressing urgency to know where it is right now. Despite the surprise uptick in January GDP, 5% is clearly restrictive in Canada. The labour market is weak and the consumer has almost tapped out, so the uptick in Q1 growth is being driven by one-time factors.If inflation looks headed for 2% and the economy remains soft, there's little danger that the first 100 basis points or so of cuts would take us through neutral and result in an overheating.

Chart 1: BoC to raise neutral by 25bps and the Fed eventually to bring their view higher by 75bps



Source: Bank of Canada, Federal Reserve, Bloomberg, CIBC

A very long-term neutral rate, which could be thought of as the average rate over the coming decade, would be of some use to bond investors thinking about the long end of the curve. But what the Bank could use, and what markets will also be trying to assess, is where the neutral rate might be in 2026, since that could end up being the end point for the next easing cycle if we achieve a soft landing. As we showed in earlier research, past easing cycles that didn't come amidst bruising recessions typically ended near where the neutral rate was at that time.

But measuring where neutral lies a couple of years out is fraught with difficulties, and we'll only really know it when we see how the economy does as we get near to it. That has implications for how much weight market participants should put on the BoC's updated estimate, and particularly on the likelihood that it could be a bit above the Fed's current 2.6% estimate for the US neutral rate.

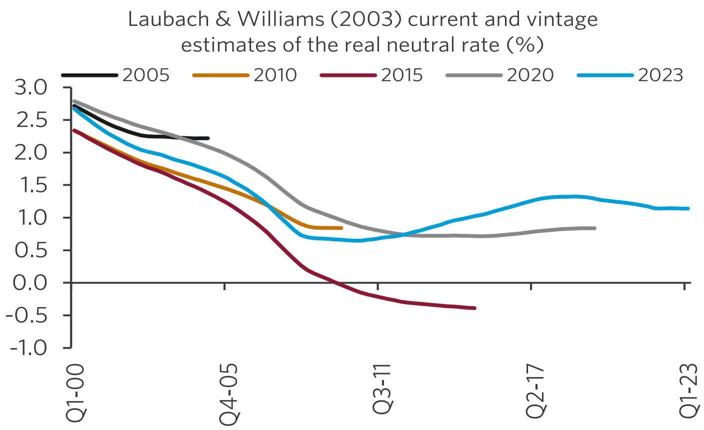
Economists' track record: no heroic forecasts

If we're going to place a lot of confidence in any estimate of where the neutral rate is headed, it would help if economists had a good track record on that task in the past. There's no such luck.

Historically, in the 1980s and 1990s, economists typically assumed that the neutral rate was essentially fixed, at a real rate of 2%. But it was many years later, around 2000, before economists made a convincing case that the actual neutral rate had been moving materially over those decades

One of the first and most popular approaches that uncovered that miss was set out by Laubach and Williams. Their methodology essentially linked a short-run measure of the real neutral rate, "r-star", with the trend rate of growth. But estimating the trend rate of growth itself is no easy feat, and it's even more challenging to know where it's headed. Looking at vintage estimates from this model over the past decade and

Chart 2: Vintage forecasts of the neutral rate have continually missed the mark

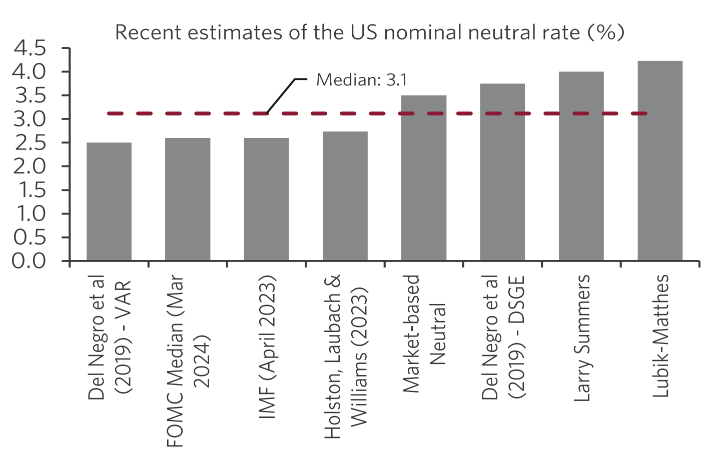


Source: NY Federal Reserve, CIBC

half shows that neutral rate estimates were all over the map (Chart 2). The current estimate brushes aside the era of negative rates of the previous decade and pre-2009 predictions provided no heroic warnings of the subsequent plunge in neutral rates. Laubach and Williams, as well more recent incarnations, struggle to split what is trend and what is cyclical in real-time.

There's been a similar lack of foresight with methods that draw on fixed income markets to infer where investors think short rates will sit several years out, on the idea that they will be assuming that rates will over time average around neutral. In 2007, just before a deep financial crisis that wasn't foreseen, such models were still consistent with neutral being a real rate of roughly 1.5%, roughly a full percentage point above where they were destined to head. Moreover, the neutral rate was persistently well below a 1% real rate for the subsequent decade.

Chart 3: Recent US nominal neutral rate estimates are all over the map



Source: Federal Reserve Board of Governors, NY Federal Reserve, Richmond Federal Reserve, Bloomberg, IMF, CIBC

We may be at similar point of uncertainty right now. Comparing eight different measures of the nominal US neutral rate, from structural models, market-based measures and just plain old opinion, show there's no clear consensus on where neutral is today (Chart 3). These estimates point to a nominal neutral rate range of 2.5% to slightly over 4%. That's not very helpful in fine tuning policy decisions.

Forecastable in theory, but not in practice

Economists think of the neutral rate as determined by the broader balance of saving and investment. Forces that encourage more saving depress the neutral rate, while sustained shifts in investment demand can push the neutral rate higher.

So the start of any neutral rate analysis starts with a list of the variables that impact savings and investment. For small-open economies like Canada, that would include are the US neutral rate, potential output, demographics, fiscal policy, and demand for long-term bonds, amongst others. But the US neutral rate is in turn impacted by various underpinnings of global savings and investment. Central banks often have a patchwork of models emphasizing a few of these forces, and usually don't provide a complete picture of how all of them work together.

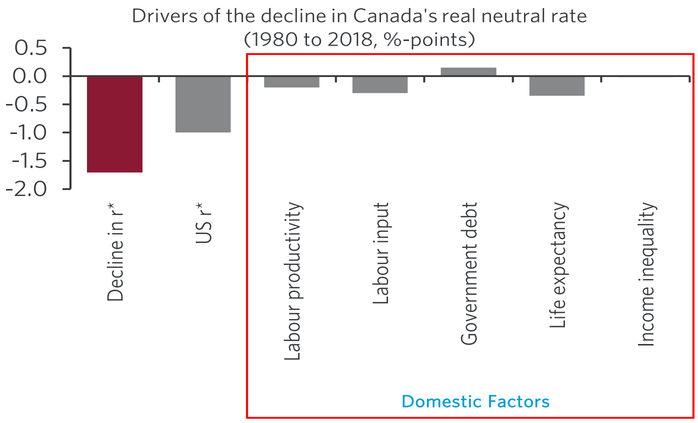
Prognosticators like to go down the list of variables and argue how each is going to nudge neutral this way or that way. But that approach has not worked out well in practice. As a case in point, McKinsey asserted in 2010 that neutral rates would climb materially over the decade ahead, and cited a surge in investment. Instead, investment and interest rates plunged. Today many are making the same argument based on rising investment demand propelled by the climate transition and AI as well as higher government spending. Good luck forecasting these variables, much less identifying their independent impact on the neutral rate.

What the BoC is likely to say

The Bank of Canada has its own patchwork of four separate models to derive Canada's neutral rate. Most of those models depend on the US neutral rate as an input, and the Bank has multiple approaches to estimating that rate. Little wonder, then, that they publish a 100 basis point band, rather than a point estimate, for the Canadian neutral rate. That band ought to now be even wider, since we don't have an up-to-date perspective from seeing how the economy performs with rates near neutral, and much of the data in the last three years was heavily distorted by the pandemic.

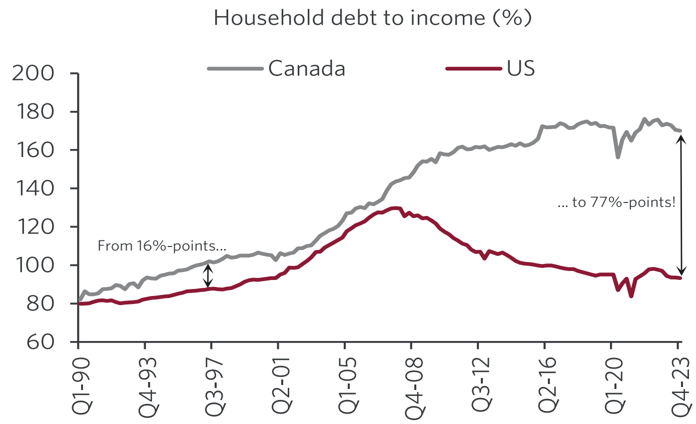
We can't fully replicate most of these models, but we don't need to, since as it turns out, we can still make a reasonable guestimate of where they will land. Almost certainly, it will be higher than the current 2.5%. The Bank has not been shy about that either, with the Governor and former Deputy Governor Paul Beaudry repeating a few times last year that there is a "risk" that neutral will be higher.

Chart 4: The BoC's latest neutral model continues to put a lot of weight on the US neutral rate



Source: Low elasticity of country-risk premium case presented in Kuncl & Matveev (2023), CIBC

Chart 6: Household debt burdens should push Canada's r* lower than the US



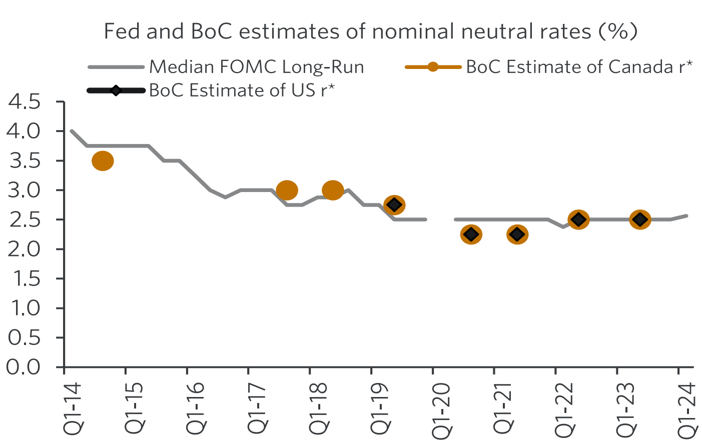
Source: Statistics Canada, Bureau of Economic Analysis, CIBC

In large part, the four approaches collectively give so much weight to the US figure that they rarely diverge much. Even the Bank's newest and richest model that they developed last year and incorporates a broad array domestic factors suggests that nearly 60% of the drop in Canada's neutral rate over the past 40 years could be due to the US neutral rate (Chart 4). So in practice, the BoC neutral rate nearly always coincides with the FOMC's "long run" dot plot forecast or its own estimate of where the US neutral rate is (Chart 5).

We expect the BoC to raise its own estimate of the US neutral rate in the April MPR, so our base case is that the midpoint of the BoC's neutral rate range will follow suit rising by 25bps to a mid-point of 2.75. A downward adjustment to trend Canadian productivity growth would lean against that, and the Bank will have to assess how the recent population surge, but new measures to contain it, will impact both the level and growth rate of potential GDP.

Sure, the Bank will couch that with references to considerable uncertainty, and might also mention that the neutral rate can

Chart 5: BoC neutral estimates move in lock and step with the US neutral



Source: Federal Reserve Board of Governors, Bank of Canada, CIBC

diverge from this longer term concept. It will also note that the current policy rate is clearly restrictive even with a higher estimated neutral rate, leaving elbow room to ease as need be. But despite all of that verbiage, markets might end up putting a lot of weight, and perhaps too much weight, on the midpoint, and conclude that the Fed and the Bank of Canada will take rates to equivalent levels ahead, or even see Canada's rate higher in the long term until the Fed pushes up its neutral rate in upcoming quarters.

Vive la difference

One problem with this one-size-fits-all neutral rate is that there's considerable evidence, going back nearly a decade, that Canada's neutral rate has already been lower than the US rate. In the prior cycle, the Canadian economy was materially slowing in 2019 with an overnight rate of only 1.75%, while the US saw enough momentum to take the fed funds rate to 2½%.

In the current cycle, Canadian growth was visibly sagging after the overnight rate hit 4.5%, although a one-quarter bump in growth ultimately had the Bank of Canada tack on an extra 50 bps. But the stall in interest-sensitive sectors and domestic demand made it abundantly clear that the current 5% rate is quite restrictive. That's in sharp contrast to the resilience that US growth has shown with an overnight rate that's 37 bps higher. The gap reflects rising savings rates in Canada and falling savings rates in the US, indicative of a divergent response to similar levels of real interest rates.

There are also sound reasons to expect that this gap in neutral rates will persist in the next few years. Canadians, more indebted than their American neighbours, facing a debt-to-income burden almost 80%-points higher than seen stateside (Chart 6), means that debt servicing costs absorb roughly 1½ times what they do in the US as a share of after-tax income. Unlike Americans with low mortgage rates locked in prior to or at the height of the pandemic, about half of all Canadian mortgages are still facing a refinancing at higher interest rates through 2026, unless we see deep cuts in interest rates before then.

Curiously, the Bank's neutral rate models place essentially no weight on the role of private household debt burdens and the structure of US and Canadian mortgage markets. That is surprising because not only is this one of the main considerations for the Bank in assessing how well monetary policy is working, but also because there is a strong theoretical case to including household debt in neutral rate modelling. Three prominent economists from Princeton, Harvard and the University of Chicago proposed the idea of "indebted demand" in 2021 — that higher debt burdens cause borrowers to reduce their spending, pushing up savings in the economy and depressing the neutral rate. If this force were in the models, it would undermine the case for having the Canadian neutral rate estimate march higher if the US rate heads that way.

A guide for policy, or a hazard?

Markets will likely make a bigger deal out of the Bank and eventually the Fed's reassessment of neutral than they should. But we don't expect central bankers to show a lot of confidence in these estimates. The neutral rate is just one way to assess the stance of monetary policy, but it is just so imprecise that it can be just as much of hazard as it can be a guide for policy. Both central banks are fully aware of this, and will judge how tight monetary policy is by looking at the data first. As they ease policy, they'll pay close attention to how well the economy is actually faring, and investors would be wise to not lean heavily on neutral rate estimates as a guide to where rate cuts will come first, or be more aggressive.

While GDP growth will likely surprise to the upside in 24Q1, that should not be hurdle for rate relief in Canada. Most of the forces driving that upturn — the end of public sector strikes in Quebec and the removal of supply bottlenecks — are not durable trends. We also don't discount the prospect of some residual seasonality. The strength in January has feelings of déjà vu after almost exact same pattern last year. The Canadian and US economies are still set to slow until rate relief starts to kick in (Table 1 & 2). The softer underlying growth path of the Canadian economy should entail a steeper path to lower rates than we we'll see in the US (Table 3 & 4). While we've pared back our call for Fed cuts this year by a quarter point, we see enough of a slowdown ahead in the US to bring the Fed into rate cuts in the latter of the year, but no pressing need to get to wherever the neutral rate is in a hurry.

Table 1: Canada forecast detail (real % change, SAAR, unless otherwise noted)

Variable	23Q3A	23Q4A	24Q1F	24Q2F	24Q3F	24Q4F	2023A	2024F	2025F
Real GDP Growth (AR)	-0.5	1.0	2.8	0.0	0.5	1.2	1.1	1.0	1.6
Real Final Domestic Demand (AR)	0.8	-0.7	1.9	0.7	1.4	1.3	0.5	0.9	1.8
Household Consumption (AR)	0.5	1.0	2.2	0.2	0.5	0.8	1.7	0.9	1.4
All Items CPI Inflation (Y/Y)	3.7	3.2	2.8	2.5	1.9	1.9	3.9	2.3	1.8
Unemployment Rate (%)	5.5	5.8	5.9	6.2	6.3	6.2	5.4	6.1	5.8

Table 2: US forecast detail (real % change, SAAR, unless otherwise noted)

Variable	23Q3A	23Q4A	24Q1F	24Q2F	24Q3F	24Q4F	2023A	2024F	2025F
Real GDP Growth (AR)	4.9	3.4	2.0	1.5	0.9	1.7	2.5	2.3	1.9
Real Final Sales (AR)	3.6	3.9	1.7	1.6	2.0	1.4	2.9	2.3	1.9
All Items CPI Inflation (Y/Y)	3.5	3.2	3.1	2.8	2.5	2.6	4.1	2.8	2.5
Core CPI Inflation (Y/Y)	4.4	4.0	3.8	3.3	3.1	2.9	4.8	3.3	2.5
Unemployment Rate (%)	3.7	3.7	3.8	4.1	4.2	4.2	3.6	4.1	4.0

Table 3: Canadian interest rates (end of period)

Variable	2024 Apr 5	2024 Jun	2024 Sep	2024 Dec	2025 Mar	2025 Jun	2025 Sep	2025 Dec
Overnight target rate	5.00	4.75	4.50	4.00	3.50	3.25	3.00	2.75
98-Day Treasury Bills	5.00	4.60	4.35	3.85	3.40	3.15	2.85	2.60
2-Year Government Bond	4.26	3.90	3.70	3.25	3.00	2.85	2.75	2.85
10-Year Government Bond	3.66	3.35	3.30	3.25	3.10	3.05	3.00	3.05
30-Year Government Bond	3.56	3.45	3.35	3.30	3.25	3.20	3.15	3.25
Canada - US T-Bill Spread	-0.37	-0.70	-0.45	-0.05	-0.70	-0.70	-0.80	-0.75
Canada - US 10-Year Bond Spread	-0.76	-0.85	-0.80	-0.65	-0.70	-0.65	-0.50	-0.50
Canada Yield Curve (10-year — 2-year)	-0.60	-0.55	-0.40	0.00	0.10	0.20	0.25	0.20

Table 4: US Interest rates (end of period)

Variable	2024 Apr 5	2024 Jun	2024 Sep	2024 Dec	2025 Mar	2025 Jun	2025 Sep	2025 Dec
Federal funds rate (midpoint)	5.375	5.375	4.875	4.625	4.125	3.875	3.625	3.375
91-Day Treasury Bills	5.37	5.30	4.80	3.90	4.10	3.85	3.65	3.35
2-Year Government Note	4.73	4.35	3.85	3.50	3.10	3.00	2.85	2.85
10-Year Government Note	4.42	4.20	4.10	3.90	3.80	3.70	3.50	3.55
30-Year Government Bond	4.56	4.45	4.30	4.25	4.15	4.00	3.90	3.95
US Yield curve (10-year — 2-year)	-0.31	-0.15	0.25	0.40	0.70	0.70	0.65	0.70

Table 5: Foreign exchange rates

Exchange rate	2024 Apr 5	2024 Jun	2024 Sep	2024 Dec	2025 Mar	2025 Jun	2025 Sep	2025 Dec
CAD-USD	0.73	0.73	0.74	0.74	0.75	0.77	0.77	0.78
USD-CAD	1.36	1.37	1.35	1.35	1.33	1.30	1.30	1.29
USD-JPY	151	155	147	145	143	140	140	140
EUR-USD	1.08	1.07	1.09	1.11	1.12	1.13	1.14	1.15
GBP-USD	1.26	1.25	1.27	1.31	1.32	1.32	1.33	1.34
AUD-USD	0.66	0.66	0.66	0.67	0.67	0.68	0.68	0.69
USD-CNY	7.23	7.30	7.25	7.20	7.18	7.15	7.15	7.15
USD-BRL	5.05	5.05	5.20	5.00	5.10	5.10	5.00	5.00
USD-MXN	16.48	17.50	18.00	17.50	17.50	17.80	17.80	17.50

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Canadian Economic Outlook for May 31, 2024

A Publication of BMO Capital Markets Economic Research • Douglas Porter, CFA, Chief Economist, BMO Financial Group

		2023 Q1	Q2	Q3	Q4	2024 Q1	Q2	Q3	Q4	2025 Q1	Q2	Q3	Q4	2022	2023	2024	2025
Production	**q/q % chng : a.r.**																
Real GDP (chain-weighted)		3.4	0.7	-0.3	0.1	1.7	**1.5**	**1.5**	**2.0**	**2.3**	**2.0**	**2.0**	**1.9**	3.8	1.2	**1.0**	**2.0**
Final Sales		5.8	0.5	-0.9	0.5	3.2	**2.3**	**1.6**	**2.1**	**2.5**	**2.1**	**2.0**	**1.9**	1.5	2.0	**1.6**	**2.1**
Final Domestic Demand		1.7	1.2	0.2	0.0	2.9	**1.7**	**1.8**	**2.2**	**2.5**	**2.1**	**2.0**	**1.9**	2.8	0.5	**1.5**	**2.1**
Consumer Spending		2.9	0.5	0.1	3.2	3.0	**1.7**	**1.3**	**1.9**	**2.2**	**1.9**	**1.9**	**1.8**	5.1	1.7	**2.0**	**1.9**
Durables		2.1	-2.6	4.4	8.7	0.4	**1.0**	**1.5**	**1.5**	**2.0**	**1.6**	**1.3**	**1.3**	-1.8	2.1	**2.5**	**1.6**
Nondurables		-0.8	1.4	-1.7	0.4	-0.3	**0.8**	**1.3**	**1.8**	**2.0**	**1.5**	**1.3**	**1.3**	-0.3	-0.4	**0.3**	**1.6**
Services		3.6	0.9	1.5	3.5	4.3	**2.3**	**1.3**	**2.0**	**2.5**	**2.2**	**2.4**	**2.3**	9.1	2.7	**2.7**	**2.1**
Government Spending		4.3	0.0	4.3	-1.6	2.1	**2.0**	**3.0**	**3.0**	**3.0**	**2.4**	**2.4**	**2.4**	3.3	2.1	**1.7**	**2.7**
Business Investment		2.3	15.5	-16.8	-13.5	3.5	**2.0**	**2.1**	**2.0**	**2.3**	**2.0**	**2.2**	**2.0**	4.0	-0.8	**-2.5**	**2.1**
Non-residential Construction		2.4	11.9	-13.3	-14.7	1.9	**2.0**	**2.2**	**2.0**	**2.3**	**2.0**	**2.5**	**2.0**	6.7	2.6	**-2.8**	**2.2**
Machinery and Equipment		2.1	22.2	-22.5	-11.3	6.4	**2.0**	**2.0**	**2.0**	**2.5**	**2.0**	**2.0**	**2.0**	-0.3	-6.4	**-1.9**	**2.1**
Residential Construction		-14.2	-4.1	9.8	-2.3	1.3	**1.0**	**2.0**	**2.0**	**2.5**	**2.0**	**2.3**	**1.5**	-12.1	-10.3	**1.4**	**2.1**
Exports		15.6	3.1	-3.2	3.2	1.9	**2.8**	**2.4**	**2.4**	**2.2**	**2.0**	**2.0**	**2.0**	3.2	5.4	**1.8**	**2.2**
Imports		2.3	5.7	-0.2	0.9	1.5	**1.2**	**3.0**	**2.5**	**2.0**	**2.0**	**2.0**	**2.0**	7.6	0.9	**1.6**	**2.2**
Inventory Change	2017$ blns : a.r.	37.1	37.7	41.3	39.5	30.0	**24.5**	**24.0**	**23.4**	**22.4**	**22.4**	**22.5**	**22.6**	55.3	38.9	**25.4**	**22.5**
Contrib. to GDP Growth	ppts : a.r.	-2.5	0.3	0.6	-0.5	-1.5	**-0.8**	**-0.1**	**-0.1**	**-0.2**	**0.0**	**0.0**	**0.0**	2.3	-0.8	**-0.5**	**-0.1**
Net Exports	2017$ blns : a.r.	-60.5	-65.9	-71.3	-67.4	-66.9	**-64.2**	**-65.8**	**-66.3**	**-66.4**	**-66.7**	**-67.0**	**-67.4**	-96.8	-66.3	**-65.8**	**-66.9**
Contrib. to GDP Growth	ppts : a.r.	4.5	-0.9	-1.0	0.8	0.1	**0.5**	**-0.2**	**0.0**	**0.0**	**0.0**	**0.1**	**0.1**	-1.5	1.5	**0.1**	**0.0**
Nominal GDP	$ blns : a.r.	2,841	2,866	2,909	2,952	2,954	**2,985**	**3,012**	**3,042**	**3,075**	**3,106**	**3,137**	**3,167**	2,813	2,892	**2,998**	**3,121**
Growth	q/q % chng : a.r.	0.3	3.5	6.1	6.1	0.3	**4.2**	**3.6**	**4.1**	**4.4**	**4.1**	**4.1**	**3.9**	11.8	2.8	**3.7**	**4.1**
Real GDP	y/y % chng	2.0	1.3	0.7	1.0	0.5	**0.7**	**1.2**	**1.7**	**1.8**	**2.0**	**2.1**	**2.1**				
Inflation	**q/q % chng : a.r.**																
GDP Price Index		-3.2	3.0	6.4	6.0	-1.3	**2.6**	**2.1**	**2.0**	**2.0**	**2.0**	**2.0**	**1.9**	7.7	1.5	**2.6**	**2.1**
CPI All Items		2.6	2.8	4.9	2.5	1.3	**2.3**	**3.0**	**2.8**	**1.7**	**2.1**	**2.3**	**2.2**	6.8	3.9	**2.6**	**2.3**
Ex. Food and Energy		3.6	3.5	3.1	3.4	1.9	**2.1**	**3.2**	**3.0**	**1.9**	**2.2**	**2.5**	**2.3**	4.9	4.0	**2.7**	**2.4**
Food Prices		8.4	5.6	3.8	3.1	1.2	**-0.1**	**2.8**	**2.3**	**1.8**	**2.0**	**1.8**	**2.0**	8.7	7.8	**2.1**	**1.9**
Energy Prices		-15.5	-5.3	19.8	-10.6	0.3	**13.5**	**1.6**	**1.5**	**-0.5**	**2.3**	**2.0**	**2.4**	24.1	-4.1	**2.6**	**2.0**
Services		3.1	5.6	5.1	4.1	2.3	**4.2**	**2.9**	**2.6**	**1.9**	**2.2**	**2.5**	**2.3**	5.0	4.6	**3.7**	**2.4**
CPI All Items	y/y % chng	5.1	3.5	3.7	3.2	2.8	**2.7**	**2.3**	**2.3**	**2.4**	**2.4**	**2.2**	**2.1**				
CPIX8	y/y % chng	4.6	3.6	3.1	2.7	2.1	**1.7**	**1.9**	**2.1**	**2.5**	**2.3**	**1.7**	**1.8**	5.7	3.6	**2.0**	**2.1**
Core CPIs (Trim/Median avg.)	y/y % chng : avg.	4.8	4.0	3.8	3.5	3.2	**2.7**	**2.3**	**2.2**	**2.4**	**2.4**	**2.0**	**1.8**	5.1	4.0	**2.6**	**2.1**
Financial	**% : quarterly avg.**																
Overnight Rate		4.50	4.58	5.00	5.00	5.00	**4.92**	**4.67**	**4.42**	**4.17**	**3.92**	**3.75**	**3.50**	2.04	4.77	**4.75**	**3.83**
3-Month T-Bill		4.39	4.54	5.02	5.01	4.94	**4.80**	**4.50**	**4.30**	**4.05**	**3.80**	**3.65**	**3.50**	2.17	4.74	**4.65**	**3.75**
90-Day BAs		5.01	5.11	5.47	5.52	5.38	**5.20**	**4.90**	**4.70**	**4.45**	**4.20**	**4.00**	**3.85**	2.79	5.28	**5.05**	**4.10**
10-Year Bond Yield		3.04	3.10	3.64	3.67	3.43	**3.65**	**3.45**	**3.30**	**3.25**	**3.25**	**3.20**	**3.20**	2.77	3.36	**3.45**	**3.20**
10-Year BBB Corporate Spread	ppts	2.18	2.16	2.12	2.11	1.86	**1.80**	**1.85**	**1.90**	**1.92**	**1.94**	**1.96**	**1.98**	2.15	2.14	**1.85**	**1.95**
90 Day Canada/U.S. Spread	bps	-39	-72	-52	-51	-52	**-65**	**-91**	**-86**	**-85**	**-79**	**-75**	**-75**	9	-53	**-73**	**-79**
10 Year Canada/U.S. Spread	bps	-61	-50	-51	-77	-73	**-84**	**-80**	**-76**	**-75**	**-75**	**-75**	**-75**	-18	-60	**-78**	**-75**
Foreign Trade	**$ blns : a.r.**																
Current Account Balance		-14.9	-27.0	-24.0	-18.0	-21.5	**-18.2**	**-21.4**	**-23.0**	**-23.6**	**-25.0**	**-26.9**	**-28.3**	-10.3	-21.0	**-21.0**	**-26.0**
Share of GDP		-0.5	-0.9	-0.8	-0.6	-0.7	**-0.6**	**-0.7**	**-0.8**	**-0.8**	**-0.8**	**-0.9**	**-0.9**	-0.4	-0.7	**-0.7**	**-0.8**
Merchandise Balance		6.2	-22.8	0.5	8.6	-4.4	**1.2**	**0.3**	**0.1**	**0.5**	**0.5**	**-0.5**	**-1.5**	19.7	-1.9	**-0.7**	**-0.2**
Non-Merchandise Balance		-21.1	-4.2	-24.5	-26.7	-17.0	**-19.4**	**-21.7**	**-23.1**	**-24.2**	**-25.5**	**-26.4**	**-26.8**	-30.0	-19.1	**-20.3**	**-25.7**
US$	US¢/C$: qtr. avg.	74.0	74.5	74.6	73.5	74.2	**73.3**	**74.0**	**74.7**	**75.2**	**75.7**	**76.2**	**76.8**	76.9	74.1	**74.0**	**76.0**
	C$/US$: qtr. avg.	1.352	1.343	1.341	1.361	1.349	**1.363**	**1.351**	**1.339**	**1.329**	**1.320**	**1.312**	**1.303**	1.302	1.349	**1.351**	**1.316**
Yen	¥/C$: qtr. avg.	97.9	102.3	107.8	108.5	110.2	**113.6**	**113.5**	**112.6**	**112.2**	**112.0**	**111.8**	**111.6**	100.9	104.1	**112.4**	**111.9**
Euro	C$/€ : qtr. avg.	1.45	1.46	1.46	1.47	1.46	**1.47**	**1.47**	**1.46**	**1.46**	**1.46**	**1.46**	**1.46**	1.37	1.46	**1.46**	**1.46**
Corp. Profits Before Tax	y/y % chng	-38.8	-54.2	-45.2	-41.1	-26.9	**0.7**	**-2.3**	**9.4**	**20.0**	**11.4**	**11.4**	**10.1**	11.9	-45.2	**-6.0**	**13.0**
Corp. Profits After Tax	y/y % chng	-11.8	-23.5	-15.4	-10.7	-0.8	**5.0**	**-2.9**	**-5.0**	**-3.4**	**-1.1**	**5.3**	**11.4**	15.8	-15.6	**-1.0**	**2.9**
Personal Income	y/y % chng	7.5	8.1	8.4	7.1	7.6	**5.8**	**4.5**	**4.1**	**2.8**	**3.7**	**3.8**	**3.8**	6.6	7.8	**5.5**	**3.5**
Real Disposable Income	y/y % chng	0.4	1.8	3.1	2.2	4.0	**2.9**	**1.6**	**1.5**	**0.6**	**1.5**	**1.6**	**1.5**	-0.1	1.9	**2.5**	**1.3**
Savings Rate	% : quarterly avg.	4.5	4.9	6.5	6.2	6.9	**6.5**	**6.5**	**6.4**	**6.4**	**6.2**	**6.1**	**6.0**	5.4	5.5	**6.6**	**6.2**
Other Indicators	**quarterly avg.**																
Unemployment Rate	percent	5.1	5.3	5.5	5.8	5.9	**6.3**	**6.5**	**6.6**	**6.4**	**6.1**	**5.9**	**5.8**	5.3	5.4	**6.3**	**6.0**
Housing Starts	000s : a.r.	221	246	256	244	244	**238**	**237**	**242**	**240**	**245**	**247**	**250**	263	242	**240**	**245**
Existing Home Sales	y/y % chng	-37.7	-4.1	8.7	3.1	14.5	**-3.0**	**1.8**	**12.7**	**6.6**	**8.9**	**6.4**	**4.3**	-25.1	-10.8	**6.0**	**6.5**
MLS Home Price Index	y/y % chng	-14.9	-5.0	0.6	1.0	1.2	**-3.8**	**-4.2**	**-0.8**	**2.0**	**4.2**	**5.7**	**5.8**	12.0	-5.9	**-2.0**	**4.0**
Motor Vehicle Sales	mlns : a.r.	1.67	1.77	1.72	1.88	1.94	**1.90**	**1.91**	**1.94**	**1.96**	**1.97**	**1.98**	**1.98**	1.57	1.76	**1.92**	**1.97**
Employment Growth	q/q % chng : a.r.	3.9	1.8	1.7	1.9	1.5	**1.6**	**0.8**	**1.3**	**2.0**	**2.0**	**2.0**	**1.2**	4.0	2.4	**1.5**	**1.7**
Industrial Production	q/q % chng : a.r.	1.7	-1.1	-2.6	1.6	-1.7	**1.9**	**2.7**	**2.0**	**0.9**	**1.1**	**1.2**	**1.2**	3.9	-0.7	**0.3**	**1.5**
Federal Budget Balance	% of FY GDP													-1.3	**-1.4**	**-1.3**	**-1.3**

Bolded values represent forecasts

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Table 1

Global GDP Growth (Adjusted for PPP) and Inflation Rates

%	Weight*	Real GDP growth 2023	Real GDP growth 2024f	Real GDP growth 2025f	Inflation rate 2023	Inflation rate 2024f	Inflation rate 2025f
Advanced economies	**38.7**	**1.6**	**1.6**	**1.8**	**4.6**	**2.8**	**2.1**
United States	15.7	2.5	2.4	1.9	4.1	3.3	2.2
Canada	1.4	1.1	1.2	1.8	3.9	2.5	2.4
Quebec	*0.3*	*0.0*	*0.7*	*1.5*	*4.5*	*2.7*	*2.3*
Japan	3.6	1.9	0.0	1.0	3.3	2.4	1.8
United Kingdom	2.3	0.1	0.7	1.4	7.4	2.5	2.2
Eurozone	11.9	0.5	0.9	1.6	5.5	2.3	1.9
Germany	*3.3*	*0.0*	*0.3*	*1.3*	*6.0*	*2.4*	*2.0*
France	*2.3*	*0.9*	*1.0*	*1.5*	*4.9*	*2.5*	*1.9*
Italy	*1.9*	*1.0*	*0.9*	*1.3*	*5.7*	*1.6*	*1.8*
Other countries	4.2	1.3	1.7	2.2	4.7	2.7	2.1
Australia	*1.0*	*2.1*	*1.5*	*2.3*	*5.6*	*3.2*	*2.8*
Emerging and developing economies	**61.3**	**3.9**	**3.9**	**4.0**	**8.7**	**7.8**	**4.8**
North Asia	26.9	5.6	5.3	4.8	2.9	2.4	2.6
China	*18.5*	*5.2*	*5.0*	*4.1*	*0.2*	*0.6*	*1.6*
India	*7.2*	*7.6*	*6.6*	*6.6*	*5.7*	*4.6*	*4.6*
South Asia	5.2	4.1	4.2	4.5	3.5	2.5	2.6
Latin America	5.7	2.4	2.0	2.5	5.2	3.9	3.5
Mexico	*1.7*	*3.2*	*2.2*	*2.3*	*5.6*	*4.0*	*3.6*
Brazil	*2.3*	*2.9*	*1.8*	*2.3*	*4.2*	*3.9*	*3.8*
Eastern Europe	8.2	3.1	2.6	2.7	19.5	17.1	9.0
Russia	*3.2*	*3.6*	*2.3*	*1.4*	*5.9*	*5.3*	*4.6*
Other countries	15.3	2.2	2.7	3.5	19.9	19.2	10.6
South Africa	*0.6*	*0.7*	*1.2*	*2.0*	*6.1*	*5.0*	*4.6*
World	**100.0**	**3.0**	**3.0**	**3.2**	**7.1**	**5.9**	**3.8**

f: forecast; PPP: Purchasing Power Parities, exchange rate that equates the cost of a broad basket of goods and services across countries; * 2022.
World Bank, Consensus Forecasts and Desjardins Economic Studies

Table 2

Summary of Financial Forecasts

End of period in % (unless otherwise indicated)	2023 Q3	2023 Q4	2024 Q1	2024 Q2f	2024 Q3f	2024 Q4f	2025 Q1f	2025 Q2f	2025 Q3f	2025 Q4f
Key interest rate										
United States	5.50	5.50	5.50	5.50	5.50	5.00	4.75	4.50	4.00	3.75
Canada	5.00	5.00	5.00	4.75	4.50	4.00	3.50	3.25	2.75	2.50
Eurozone	4.50	4.50	4.50	4.25	4.00	3.50	3.25	3.00	2.75	2.50
United Kingdom	5.25	5.25	5.25	5.00	4.75	4.50	4.25	3.75	3.50	3.25
Federal bonds										
United States										
2-year	5.14	4.33	4.70	4.70	4.40	4.00	3.75	3.50	3.35	3.20
5-year	4.64	3.86	4.23	4.55	4.30	4.00	3.80	3.55	3.40	3.30
10-year	4.57	3.87	4.21	4.55	4.35	4.05	3.85	3.60	3.45	3.40
30-year	4.70	4.02	4.35	4.65	4.45	4.15	3.95	3.70	3.55	3.45
Canada										
2-year	4.87	3.88	4.17	3.90	3.50	3.20	2.95	2.75	2.70	2.55
5-year	4.25	3.17	3.51	3.65	3.50	3.20	3.05	2.85	2.80	2.70
10-year	4.03	3.10	3.45	3.65	3.55	3.35	3.15	2.90	2.85	2.75
30-year	3.81	3.02	3.34	3.55	3.45	3.25	3.10	2.85	2.85	2.75
Currency market										
Canadian dollar (USD/CAD)	1.36	1.32	1.35	1.38	1.38	1.37	1.37	1.36	1.35	1.34
Canadian dollar (CAD/USD)	0.74	0.75	0.74	0.73	0.73	0.73	0.73	0.74	0.74	0.75
Euro (EUR/USD)	1.06	1.10	1.08	1.07	1.08	1.09	1.10	1.11	1.12	1.12
British pound (GBP/USD)	1.22	1.27	1.26	1.26	1.27	1.28	1.29	1.30	1.32	1.33
Yen (USD/JPY)	149	141	151	154	150	145	140	137	134	132

	2023	2024	2025
Stock markets (level and growth)*			
United States – S&P 500	4,770	Target: 5,000 (+4.8%)	Target: 5,180 (+3.6%)
Canada – S&P/TSX	20,958	Target: 21,800 (+4.0%)	Target: 23,220 (+6.5%)
Commodities (annual average)			
WTI oil (US$/barrel)	78 (72*)	84 (87*)	83 (82*)
Gold (US$/ounce)	1,940 (2,030*)	2,085 (1,970*)	1,905 (1,900*)

f: forecast; WTI: West Texas Intermediate; * End of year.

Datastream and Desjardins Economic Studies

	Q1	Q2	Q3	Q4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23	[illegible]	25F	23	[illegible]	25F

Canadian Economic Outlook

[Period-Over-Period Annualized Per Cent Change Unless Otherwise Indicated]

					Q1F	Q2F	Q3F	Q4F	Q1F	Q2F	Q3F	Q4F		24F			24F	
Real GDP	2.6	0.6	-0.5	1.0	1.3	1.0	1.2	1.3	1.6	1.7	1.8	2.0	1.1	0.9	1.5	0.9	1.2	1.8
Consumer Expenditure	4.1	-0.7	0.5	1.0	3.0	1.5	0.9	0.9	1.1	1.3	1.4	1.6	1.7	1.4	1.2	1.2	1.6	1.3
Durable Goods	3.8	-3.0	4.2	7.0	7.0	2.0	1.5	1.0	1.0	1.2	1.4	1.5	2.3	4.0	1.2	2.9	2.8	1.3
Business Investment	3.2	9.6	-13.9	-7.7	3.1	2.7	3.3	3.3	3.0	3.0	3.0	3.1	-0.6	-1.0	3.1	-2.6	3.1	3.0
Non-Res. Structures	3.4	10.6	-14.3	-11.6	4.0	3.0	3.5	3.5	3.0	3.3	3.3	3.2	2.6	-1.5	3.2	-3.5	3.5	3.2
Equipment & IPP*	3.0	8.7	-13.5	-3.6	2.2	2.4	3.1	3.2	3.0	2.8	2.8	2.9	-3.8	-0.4	2.9	-1.7	2.7	2.9
Residential Investment	-14.0	-3.5	8.7	-1.7	2.0	3.3	3.7	4.0	4.2	3.9	3.5	3.3	-10.2	2.3	3.8	-3.0	3.2	3.7
Govt. Expenditure	3.5	-0.4	6.1	-1.1	2.5	2.7	2.3	2.2	2.1	2.1	2.0	2.0	2.1	2.0	2.2	2.0	2.4	2.0
Final Domestic Demand	2.2	0.4	0.8	-0.7	2.8	2.0	1.7	1.7	1.8	1.8	1.9	1.9	0.5	1.4	1.8	0.6	2.1	1.9
Exports	14.1	4.3	-1.3	5.6	-2.7	3.8	3.5	3.0	2.9	2.9	2.8	2.8	5.7	1.8	3.0	5.5	1.9	2.8
Imports	3.7	4.6	1.1	-1.7	-0.3	3.7	3.2	2.7	2.7	2.6	2.6	2.6	1.0	1.3	2.8	1.9	2.3	2.6
Change in Non-Farm																		
Inventories (2012, $Bn)	41.2	36.1	37.0	26.8	28.8	22.8	19.8	17.3	15.8	14.8	14.3	14.3	35.3	22.1	14.8	–	–	–
Final Sales	4.9	0.6	0.6	0.2	3.3	3.1	2.2	2.2	2.0	2.0	2.0	2.0	1.4	2.0	2.1	1.6	2.7	2.0
International Current																		
Account Balance ($Bn)	-18.6	-27.0	-19.0	-6.5	-1.0	-3.0	-4.8	-7.1	-8.9	-10.2	-11.3	-12.0	-17.8	-4.0	-10.6	–	–	–
% of GDP	-0.7	-0.9	-0.7	-0.2	0.0	-0.1	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.6	-0.1	-0.3	–	–	–
Pre-Tax Corp. Profits	-39.2	-25.1	22.1	19.9	-2.6	-2.9	1.2	3.4	5.3	6.6	4.4	4.5	-18.1	3.2	4.0	-9.7	-0.3	5.2
% of GDP	13.2	12.2	12.6	13.0	12.8	12.6	12.5	12.5	12.6	12.7	12.7	12.7	12.8	12.6	12.7	–	–	–
GDP Deflator (y/y)	2.2	-0.4	1.6	3.0	4.3	4.3	3.1	2.2	2.2	2.1	2.0	2.0	1.6	3.5	2.1	3.0	2.2	2.0
Nominal GDP	-0.3	3.3	6.5	6.6	3.6	3.4	3.5	3.4	3.6	3.7	3.9	4.0	2.7	4.4	3.6	4.0	3.5	3.8
Labour Force	3.9	2.7	2.9	2.8	1.9	1.6	1.2	0.9	0.8	0.9	0.9	0.9	2.6	2.0	0.9	3.1	1.4	0.9
Employment	3.9	1.8	1.7	1.9	1.6	0.4	-0.5	-0.1	1.0	1.3	1.3	1.4	2.4	1.1	0.7	2.3	0.3	1.2
Change in Empl. ('000s)	192	92	85	93	79	22	-26	-7	49	65	68	71	475	216	137	461	69	253
Unemployment Rate (%)	5.1	5.3	5.5	5.8	5.8	6.1	6.5	6.7	6.7	6.6	6.5	6.4	5.4	6.3	6.6	–	–	–
Personal Disp. Income	1.6	4.8	9.1	5.3	6.7	2.9	1.6	2.1	3.3	4.0	4.3	4.0	5.5	4.9	3.1	5.1	3.3	3.9
Pers. Savings Rate (%)	4.5	5.0	6.3	6.2	6.4	6.2	5.9	5.6	5.6	5.7	5.9	6.0	5.5	6.0	5.8	–	–	–
Cons Price Index (y/y)	5.2	3.5	3.7	3.2	3.1	3.0	2.4	2.4	2.3	2.2	2.1	2.0	3.9	2.7	2.1	3.2	2.4	2.0
CPIX (y/y)**	4.6	3.6	3.1	2.7	2.7	2.5	2.4	2.4	2.3	2.1	2.1	2.0	3.5	2.5	2.1	2.7	2.4	2.0
BoC Inflation (y/y)***	4.8	4.0	3.8	3.6	3.4	3.1	2.8	2.6	2.4	2.3	2.2	2.1	4.0	3.0	2.3	3.6	2.6	2.1
Housing Starts ('000s)	221	246	256	244	237	233	228	221	225	231	235	239	242	230	232	–	–	–
Home Prices (y/y)	-17.3	1.2	3.7	2.8	4.0	-4.2	1.0	4.4	4.6	5.0	4.1	3.6	-3.0	1.2	4.3	2.8	4.4	3.6
Real GDP / Worker (y/y)	-0.9	-1.1	-2.0	-1.4	-1.1	-0.7	0.3	0.9	1.1	1.1	0.7	0.5	-1.3	-0.2	0.9	-1.4	0.9	0.5

F: Forecast by TD Economics, March 2024. Note: Home price measure shown is the CREA Composite Sale Price.

* Intellectual Property Products ** CPIX: CPI excluding the 8 most volatile components. *** BoC Inflation: Simple average of CPI-trim and CPI-median.

Source: Statistics Canada, Bank of Canada, Canada Mortgage and Housing Corporation, Haver Analytics, TD Economics.

Interest Rate Outlook

Interest Rates	Spot Rate	2023				2024				2025			
	May-01	Q1	Q2	Q3	Q4	Q1	Q2F	Q3F	Q4F	Q1F	Q2F	Q3F	Q4F
CANADA													
Overnight Target Rate	5.00	4.50	4.75	5.00	5.00	5.00	5.00	4.75	4.25	3.75	3.25	3.00	2.75
3-mth T-Bill Rate	4.94	4.34	4.90	5.07	5.04	4.99	4.88	4.50	4.00	3.50	3.13	2.88	2.63
2-yr Govt. Bond Yield	4.29	3.74	4.58	4.87	3.88	4.17	4.35	4.05	3.75	3.45	3.15	2.85	2.55
5-yr Govt. Bond Yield	3.81	3.02	3.68	4.25	3.17	3.51	3.90	3.70	3.50	3.30	3.15	3.00	2.90
10-yr Govt. Bond Yield	3.76	2.90	3.26	4.03	3.10	3.45	3.85	3.70	3.55	3.40	3.25	3.15	3.00
30-yr Govt. Bond Yield	3.63	3.00	3.08	3.81	3.02	3.37	3.75	3.65	3.55	3.45	3.35	3.25	3.20
10-yr-2-yr Govt Spread	-0.54	-0.84	-1.32	-0.84	-0.78	-0.72	-0.50	-0.35	-0.20	-0.05	0.10	0.30	0.45
U.S.													
Fed Funds Target Rate	5.50	5.00	5.25	5.50	5.50	5.50	5.50	5.50	5.25	5.00	4.50	4.00	3.50
3-mth T-Bill Rate	5.25	4.68	5.17	5.32	5.20	5.23	5.25	5.25	5.05	4.65	4.15	3.65	3.15
2-yr Govt. Bond Yield	4.95	4.06	4.87	5.03	4.23	4.59	4.95	4.95	4.75	4.45	4.15	3.85	3.55
5-yr Govt. Bond Yield	4.64	3.60	4.13	4.60	3.84	4.21	4.70	4.65	4.40	4.15	3.90	3.70	3.50
10-yr Govt. Bond Yield	4.63	3.48	3.81	4.59	3.88	4.20	4.70	4.65	4.40	4.20	4.00	3.85	3.65
30-yr Govt. Bond Yield	4.75	3.67	3.85	4.73	4.03	4.34	4.80	4.75	4.70	4.50	4.30	4.15	3.95
10-yr-2-yr Govt Spread	-0.33	-0.58	-1.06	-0.44	-0.35	-0.39	-0.25	-0.30	-0.35	-0.25	-0.15	0.00	0.10
CANADA - U.S SPREADS													
Can - U.S. T-Bill Spread	-0.31	-0.34	-0.27	-0.25	-0.16	-0.24	-0.37	-0.75	-1.05	-1.15	-1.02	-0.77	-0.52
Can - U.S. 10-Year Bond Spread	-0.87	-0.58	-0.55	-0.56	-0.78	-0.75	-0.85	-0.95	-0.85	-0.80	-0.75	-0.70	-0.65

F: Forecast by TD Economics, May 2024; Forecasts are end-of-period. Source: Bloomberg, Bank of Canada, Federal Reserve.

Scotiabank

GLOBAL ECONOMICS

SCOTIABANK'S FORECAST TABLES

June 6, 2024

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Further Rate Cuts on the Horizon

- **We expect the Bank of Canada to cut by 25bps at each of the next three meetings.**
- **Inflation is on a good downward path though growth in the interest rate-sensitive parts of the economy remains surprisingly strong.**
- **Positive risks to the outlook for growth and inflation remain as interest rates come down. We are particularly mindful of the response in real estate markets and household spending. Any materialization of upside risks would imperil future rate cuts.**

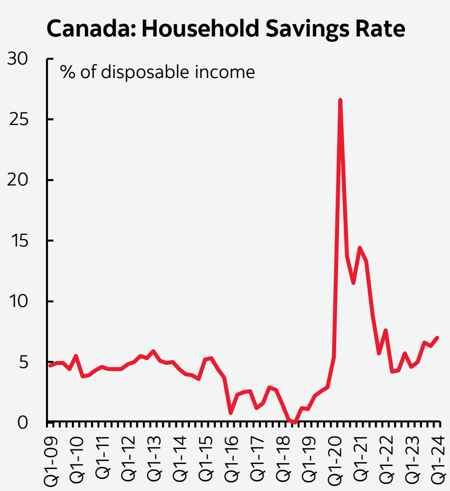
Rate cuts have finally begun in Canada. With inflation hopefully on a sustained downward path despite the interest rate-sensitive parts of our economy performing surprisingly well, it is now clear that the Bank of Canada has decided rate relief is necessary. That is great news for borrowers if the Bank of Canada follows through with additional cuts. We think they will, though we remain concerned about upside risks to inflation given rising wages and falling productivity, the surprising strength in consumption, the serial over-stimulation by the federal and provincial governments, and the potential for a housing market rebound. As a result of the latest decision and the communications around that we are changing our Bank of Canada view and now expect that Governor Macklem will cut the policy rate at each of the next three meetings, for a total of 100bps of cuts this year.

We expect well below potential growth this year of 1.2%. This is lower than our previous forecast of 1.5% owing to competing factors: while final domestic demand (which includes consumption and investment along with a few other components of GDP) is much stronger than expected, that strength is leading a large drain on inventories. Inventories subtracted 1.5% from growth in the first quarter. On balance, the drag from inventories offsets the strength in other components of GDP, accounting for much of the downward revision to our growth outlook this year. More specifically in the remainder of the year, we assume a gradual pickup in housing market activity but a moderation in consumption given the strength seen so far. This is despite an expected reduction in the saving rate as the past impact of rate hikes continue to work their way through the economy. Reflecting that past increase in rates, we see the unemployment rate rising a bit in the remainder of the year and that should put downward pressure on wage growth, and therefore income, constraining consumer spending.

There are meaningful risks to that forecast now that interest rates are on the way down. The housing sector will be the biggest beneficiary in the short run. Buyers have been waiting for interest rates to come down in a deeply and structurally undersupplied housing market. While 25bps is not a large reduction in borrowing costs, market costs have fallen markedly more. The yield on 5-year government of Canada debt is down almost 40bps in the last two weeks, for instance. The expectation of more cuts will lead to a rebound in sales. The only question is when this will occur and how aggressive of a rebound. Our hope is that the rebound is relatively muted only because a strong return in sales volumes and higher prices could imperil future cuts by the Bank of Canada. There is clearly a risk of a strong return in activity given the pent-up demand for housing and the clear fear of missing out.

Another area of focus will be on the consumer spending side. Consumption growth has been tracking significantly higher than expected in the last two quarters. There are a multitude of reasons for that, including still-reasonably healthy household balance sheets, strong employment growth, strong wage growth, and of course record population growth. What is remarkable is that even though consumption growth has been stronger than anticipated, disposable income has grown even more rapidly leading to a very high level of the personal savings rate (chart 1). It now stands at close to 7%, more than double the

Chart 1



Sources: Scotiabank Economics, Statistics Canada.

historical average. This results from spending growth being below that of income growth and is an indication that consumers were accumulating some level of pent-up demand. As interest rates come down, we expect savings behaviour to change for some of the pent-up demand to be very gradually released. One area where this is particularly evident is in motor vehicle sales, which have slowed in the last three months as buyers put off purchases in anticipation of lower rates to come. As in the case of housing, a pronounced rebound on the spending side could delay further rate cuts by the Bank of Canada.

Population growth remains a key driver of activity and despite commitments to reduce the flow of new arrivals, the pace of population growth has accelerated this year. This is not such a big surprise as there will no doubt be a rush of students and non-permanent residents that try to beat the application of new immigration rules and targets. As a consequence, it is possible that we continue to observe very rapid population growth in coming months. This would push up growth in household spending and GDP, though it might also require an upward revision to potential output.

Lower rates may also impact the Canadian dollar. We have not changed our views on the Federal Reserve. We continue to expect 50bps of cuts, the first 25bps occurring in September. That would mean that the gap between Canadian and US policy rates would rise to 100bps if the Bank of Canada cuts in July. This rising rate differential should have some impact on the Canadian dollar, which we now expect will fall to 72.5 cents to the US dollar. Here too there is risk: if the Bank of Canada proceeds in line with our forecast and the Federal Reserve delays cutting interest rate, the interest rate differential would widen further and put even great downward pressure on the Canadian dollar. The Governor has noted that he would be unperturbed by the impact of rate differentials on the currency as pass through to inflation is low, but a weaker dollar raises the cost of imports of capital goods and would thus be an additional headwind to productivity growth.

The factors above suggest that upside risks to inflation remain significant, even if inflation has softened in recent readings. It is clear that the Bank of Canada takes great comfort from the recent performance of inflation, as they should. That comfort and the Governor's observation that rates will continue to come down if the economy and inflation perform as expected going forward suggest a real commitment to lower borrowing costs. We interpret that as the Bank of Canada cutting at each of the next meetings unless developments, such as the potential for those above, throw things off track.

International

	2010–19	2021	2022	2023	2024f	2025f	2010–19	2021	2022	2023	2024f	2025f
	Real GDP (annual % change)						**Consumer Prices** (annual average % change, unless noted)					
World (based on purchasing power parity)	3.7	6.5	3.2	3.2	3.0	3.0						
Canada	2.2	5.3	3.8	1.2	1.2	2.1	1.6	3.4	6.8	3.9	2.6	2.2
United States	2.4	5.8	1.9	2.5	2.3	1.8	1.8	4.7	8.0	4.1	3.1	2.4
Mexico	2.3	6.0	3.7	3.2	2.4	1.6	4.0	5.7	7.9	5.5	4.6	3.9
United Kingdom	2.0	8.7	4.3	0.1	0.7	1.2	2.2	2.6	9.1	7.3	2.5	2.1
Eurozone	1.4	5.9	3.5	0.5	0.7	1.4	1.4	2.6	8.4	5.4	2.4	2.0
Germany	2.0	3.1	1.9	0.0	0.3	1.4	1.4	3.2	8.7	3.0	2.4	2.0
France	1.4	6.8	2.6	0.9	0.8	1.2	1.3	2.1	5.9	5.7	2.5	2.0
China	7.7	8.4	3.0	5.2	4.9	4.5	2.6	0.9	2.0	0.2	0.7	1.5
India	7.1	9.7	7.0	8.2	6.8	6.5	6.2	6.7	5.7	5.7	4.8	4.5
Japan	1.2	2.7	1.0	1.9	0.4	1.1	0.5	-0.3	2.5	3.3	2.4	1.8
South Korea	3.5	4.3	2.6	1.4	2.5	2.2	1.7	2.5	5.1	3.6	2.6	2.0
Australia	2.6	5.7	3.8	2.0	1.3	2.2	2.1	2.9	6.6	5.6	3.4	2.8
Thailand	3.6	1.6	2.5	1.9	2.6	3.2	1.6	1.2	6.1	1.3	0.8	1.7
Brazil	1.4	4.8	3.0	2.9	2.1	2.0	5.8	8.3	9.3	4.5	3.9	3.8
Colombia	3.7	10.8	7.3	0.6	1.4	2.2	3.7	3.5	10.2	11.8	6.9	3.9
Peru	4.5	13.4	2.7	-0.6	2.7	2.5	2.8	4.0	7.9	6.3	2.4	2.3
Chile	3.3	11.3	2.1	0.2	3.0	2.5	3.0	4.5	11.6	7.3	3.3	2.7

Commodities

	2010–19	2021	2022	2023	2024f	2025f
	(annual average)					
WTI Oil (USD/bbl)	74	68	95	78	80	75
Brent Oil (USD/bbl)	82	70	101	83	85	80
WCS - WTI Discount (USD/bbl)	-18	-14	-21	-19	-15	-14
Nymex Natural Gas (USD/mmbtu)	3.39	3.85	6.61	2.73	2.60	3.75
Copper (USD/lb)	3.10	4.23	4.00	3.85	4.50	5.00
Zinc (USD/lb)	1.02	1.36	1.58	1.20	1.25	1.25
Nickel (USD/lb)	7.00	8.37	11.66	9.75	8.55	8.50
Iron Ore (USD/tonne)	101	160	121	120	112	90
Metallurgical Coal (USD/tonne)	179	204	372	288	260	225
Gold, (USD/oz)	1,342	1,799	1,803	1,943	2,200	2,200
Silver, (USD/oz)	21.64	25.15	21.80	23.38	25.60	26.00

Sources: Scotiabank Economics, Statistics Canada, Focus Economics, BEA, BCB, BLS, IMF, Bloomberg.

North America

	2010–19	2021	2022	2023	2024f	2025f	2010–19	2021	2022	2023	2024f	2025f
			Canada (annual % change, unless noted)						United States (annual % change, unless noted)			
Real GDP	2.2	5.3	3.8	1.2	1.2	2.1	2.4	5.8	1.9	2.5	2.3	1.8
Consumer spending	2.5	5.1	5.1	1.7	1.6	1.3	2.3	8.4	2.5	2.2	2.2	1.5
Residential investment	2.4	14.6	-12.0	-10.2	2.0	7.2	4.7	10.7	-9.0	-10.6	4.5	1.7
Business investment*	3.0	9.1	4.3	-0.6	-2.1	3.9	5.6	5.9	5.2	4.5	3.3	1.7
Government	1.1	4.6	3.3	2.1	2.1	2.2	0.2	-0.3	-0.9	4.1	2.0	0.9
Exports	3.5	2.7	3.2	5.4	2.4	1.6	3.9	6.3	7.0	2.6	3.8	3.3
Imports	3.7	8.1	7.6	0.9	1.0	1.4	4.3	14.5	8.6	-1.7	3.5	0.3
Inventories, contribution to annual GDP growth	0.1	0.7	2.3	-0.7	-0.6	-0.1	0.1	0.2	0.5	-0.4	-0.2	-0.1
Nominal GDP	4.0	13.4	11.8	2.8	4.4	4.0	4.0	10.7	9.1	6.3	4.5	3.7
GDP deflator	1.7	7.7	7.7	1.5	3.2	1.8	1.6	4.6	7.1	3.6	2.2	1.9
Consumer price index (CPI)	1.6	3.4	6.8	3.9	2.6	2.2	1.8	4.7	8.0	4.1	3.1	2.4
Core inflation rate**	1.7	2.8	5.1	4.0	2.6	2.2	1.6	3.6	5.2	4.1	2.6	2.2
Pre-tax corporate profits	6.3	33.2	14.7	-17.4	-4.4	10.3	5.9	22.6	9.8	0.6	3.0	2.4
Employment	1.3	5.0	4.0	2.4	1.5	1.9	1.4	2.9	4.3	2.3	1.5	1.0
Unemployment rate (%)	6.9	7.5	5.3	5.4	6.2	6.5	6.2	5.4	3.6	3.6	4.0	4.1
Current account balance (CAD, USD bn)	-56.9	0.4	-10.3	-21.0	-14.6	-25.5	-407	-831	-972	-819	-812	-716
Merchandise trade balance (CAD, USD bn)	-13.6	2.5	19.7	-1.9	1.6	-7.5	-763	-1084	-1183	-1060	-1103	-1056
Federal budget balance (FY, CAD, USD bn) ***	-18.7	-90.2	-35.3	-40.0	-39.8	-38.9	-829	-2,775	-1,376	-1,695	-1,476	-1,692
percent of GDP	-1.0	-3.6	-1.3	-1.4	-1.3	-1.2	-4.8	-11.8	-5.3	-6.2	-5.2	-5.7
Housing starts (000s, mn)	201	271	262	240	248	260	0.99	1.60	1.55	1.42	1.40	1.42
Motor vehicle sales (000s, mn)	1,816	1,663	1,523	1,684	1,766	1,796	15.7	14.9	13.8	15.5	15.8	16.5
Industrial production	2.4	5.0	3.9	-0.7	0.0	2.2	1.7	4.4	3.4	0.2	-0.1	1.4
			Mexico (annual % change)									
Real GDP	2.3	6.0	3.7	3.2	2.4	1.6						
Consumer price index	4.0	5.7	7.9	5.5	4.6	3.9						
Unemployment rate (%)	4.4	4.1	3.3	2.8	3.0	3.4						

Sources: Scotiabank Economics, Statistics Canada, CMHC, BEA, BLS, Bloomberg. *For Canada it includes capital expenditures by businesses and non-profit institutions. ** US: core PCE deflator; Canada: average of 2 core measures published by the BoC. *** In order to align with US reporting, as of the August 2020 issue of Scotiabank's Forecast Tables, Canadian Federal and Provincial Budget Balances for FY2020/21 are noted in calendar year 2020, FY2021/22 in calendar year 2021.

Quarterly Forecasts

	2022	2023				2024				2025			
Canada	Q4	Q1	Q2	Q3	Q4	Q1	Q2f	Q3f	Q4f	Q1f	Q2f	Q3f	Q4f
Real GDP (q/q ann. % change)	-0.9	3.4	0.7	-0.3	0.1	1.7	2.1	1.8	2.4	2.0	2.1	2.3	2.3
Real GDP (y/y % change)	2.2	2.0	1.3	0.7	1.0	0.5	0.9	1.4	2.0	2.1	2.1	2.2	2.2
Consumer prices (y/y % change)	6.7	5.1	3.5	3.7	3.2	2.8	2.7	2.3	2.6	2.5	2.0	2.2	2.1
Average of new core CPIs (y/y % change)*	5.5	4.8	4.0	3.8	3.5	3.2	2.6	2.4	2.3	2.2	2.2	2.1	2.1
CPIXFET (y/y % change)**	5.4	4.8	4.0	3.4	3.4	2.9	2.6	2.4	2.4	2.2	2.1	2.0	2.0
Unemployment Rate (%)	5.1	5.1	5.3	5.5	5.8	5.9	6.2	6.3	6.4	6.5	6.5	6.5	6.4
United States													
Real GDP (q/q ann. % change)	2.6	2.2	2.1	4.9	3.4	1.2	1.9	1.1	1.9	2.0	1.7	1.9	1.9
Real GDP (y/y % change)	0.7	1.7	2.4	2.9	3.1	2.9	2.8	1.9	1.5	1.7	1.7	1.9	1.9
Consumer prices (y/y % change)	7.1	5.7	4.0	3.6	3.2	3.2	3.3	2.9	2.9	2.9	2.5	2.2	2.2
Total PCE deflator (y/y % change)	5.9	5.0	3.9	3.3	2.8	2.5	2.7	2.6	2.7	2.7	2.3	2.0	2.0
Core PCE deflator (y/y % change)	5.1	4.8	4.6	3.8	3.2	2.8	2.6	2.5	2.5	2.4	2.3	2.1	2.0
Unemployment Rate (%)	3.6	3.5	3.6	3.7	3.7	3.8	4.0	4.0	4.1	4.1	4.1	4.1	4.1

* Average of 2 core measures published by the BoC. ** CPI ex. food, energy and indirect taxes. Sources: Scotiabank Economics, Statistics Canada, BEA, BLS, Bloomberg.

Central Bank Rates

	2022	2023				2024				2025			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2f	Q3f	Q4f	Q1f	Q2f	Q3f	Q4f
Americas						(%, end of period)							
Bank of Canada	4.25	4.50	4.75	5.00	5.00	5.00	4.75	4.25	4.00	3.75	3.50	3.25	3.25
US Federal Reserve (upper bound)	4.50	5.00	5.25	5.50	5.50	5.50	5.50	5.25	5.00	4.50	4.00	3.50	3.50
Bank of Mexico	10.50	11.25	11.25	11.25	11.25	11.00	10.75	10.25	10.00	9.25	9.00	8.50	8.00
Central Bank of Brazil	13.75	13.75	13.75	12.75	11.75	10.75	10.25	10.25	10.25	10.00	9.50	9.25	9.25
Bank of the Republic of Colombia	12.00	13.00	13.25	13.25	13.00	12.25	11.25	9.75	8.25	6.75	5.50	5.50	5.50
Central Reserve Bank of Peru	7.50	7.75	7.75	7.50	6.75	6.25	5.50	5.00	4.50	4.50	4.00	4.00	4.00
Central Bank of Chile	11.25	11.25	11.25	9.50	8.25	7.25	5.50	4.75	4.50	4.25	4.25	4.25	4.25
Europe													
European Central Bank MRO Rate	2.50	3.50	4.00	4.50	4.50	4.50	4.25	3.40	3.15	2.90	2.65	2.40	2.15
European Central Bank Deposit Rate	2.00	3.00	3.50	4.00	4.00	4.00	3.75	3.25	3.00	2.75	2.50	2.25	2.00
Bank of England	3.50	4.25	5.00	5.25	5.25	5.25	5.25	4.75	4.25	4.00	3.75	3.50	3.25
Asia/Oceania													
Reserve Bank of Australia	3.10	3.60	4.10	4.10	4.35	4.35	4.35	4.35	4.10	3.85	3.60	3.60	3.35
Bank of Japan	-0.10	-0.10	-0.10	-0.10	-0.10	0.00	0.00	0.00	0.20	0.20	0.25	0.25	0.45
People's Bank of China	2.75	2.75	2.65	2.50	2.50	2.50	2.50	2.40	2.30	2.30	2.30	2.30	2.30
Reserve Bank of India	6.25	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.25	6.00	6.00	6.00	6.00
Bank of Korea	3.25	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.25	3.00	2.75	2.50	2.50
Bank of Thailand	1.25	1.75	2.00	2.50	2.50	2.50	2.50	2.50	2.25	2.00	2.00	2.00	2.00

Currencies and Interest Rates

	2022 Q4	2023 Q1	2023 Q2	2023 Q3	2023 Q4	2024 Q1	2024 Q2f	2024 Q3f	2024 Q4f	2025 Q1f	2025 Q2f	2025 Q3f	2025 Q4f
Americas						(end of period)							
Canadian dollar (USDCAD)	1.36	1.35	1.32	1.36	1.32	1.35	1.38	1.38	1.36	1.34	1.32	1.32	1.30
Canadian dollar (CADUSD)	0.74	0.74	0.76	0.74	0.76	0.74	0.72	0.72	0.74	0.75	0.76	0.76	0.77
Mexican peso (USDMXN)	19.50	18.05	17.12	17.42	16.97	16.56	17.60	17.90	18.20	18.50	18.80	19.25	19.50
Brazilian real (USDBRL)	5.28	5.06	4.79	5.03	4.86	5.01	5.09	5.07	5.05	5.03	5.02	5.05	5.07
Colombian peso (USDCOP)	4,853	4,623	4,172	4,067	3,855	3,852	4,078	4,102	4,116	4,120	4,125	4,140	4,150
Peruvian sol (USDPEN)	3.81	3.76	3.63	3.78	3.70	3.72	3.75	3.80	3.75	3.75	3.75	3.80	3.75
Chilean peso (USDCLP)	851	795	802	892	879	979	940	900	870	870	870	870	870
Europe													
Euro (EURUSD)	1.07	1.08	1.09	1.06	1.10	1.08	1.07	1.07	1.09	1.11	1.11	1.15	1.15
UK pound (GBPUSD)	1.21	1.23	1.27	1.22	1.27	1.26	1.25	1.25	1.27	1.29	1.29	1.31	1.31
Asia/Oceania													
Japanese yen (USDJPY)	131	133	144	149	141	151	150	150	150	145	145	140	140
Australian dollar (AUDUSD)	0.68	0.67	0.67	0.64	0.68	0.65	0.66	0.68	0.68	0.70	0.70	0.72	0.72
Chinese yuan (USDCNY)	6.90	6.87	7.25	7.30	7.10	7.22	7.24	7.23	7.19	7.15	7.11	7.05	7.00
Indian rupee (USDINR)	82.7	82.2	82.0	83.0	83.2	83.4	83.3	83.3	83.2	83.1	83.1	83.2	83.3
South Korean won (USDKRW)	1,265	1,302	1,318	1,349	1,288	1347	1361	1349	1335	1321	1308	1296	1284
Thai baht (USDTHB)	34.6	34.2	35.5	36.4	34.1	36.4	36.8	36.4	36.1	35.7	35.4	35.2	35.0
Canada (Yields, %)													
3-month T-bill	4.32	4.42	4.91	5.11	5.03	4.95	4.40	4.05	3.70	3.55	3.30	3.20	3.20
2-year Canada	4.05	3.73	4.58	4.87	3.89	4.18	3.85	3.75	3.60	3.50	3.40	3.40	3.40
5-year Canada	3.41	3.02	3.68	4.25	3.17	3.53	3.35	3.40	3.45	3.50	3.50	3.50	3.50
10-year Canada	3.30	2.90	3.27	4.02	3.11	3.47	3.35	3.45	3.50	3.60	3.60	3.60	3.60
30-year Canada	3.28	3.00	3.09	3.81	3.03	3.35	3.25	3.35	3.40	3.50	3.50	3.50	3.50
United States (Yields, %)													
3-month T-bill	4.41	4.80	5.31	5.46	5.35	5.40	5.30	4.95	4.60	4.10	3.65	3.40	3.30
2-year Treasury	4.43	4.03	4.90	5.04	4.25	4.62	4.70	4.30	4.10	3.75	3.60	3.60	3.60
5-year Treasury	4.00	3.57	4.16	4.61	3.85	4.21	4.30	4.25	4.20	4.15	4.05	3.95	3.80
10-year Treasury	3.88	3.47	3.84	4.57	3.88	4.20	4.30	4.30	4.30	4.20	4.10	4.10	4.05
30-year Treasury	3.97	3.65	3.86	4.70	4.03	4.34	4.50	4.45	4.40	4.30	4.25	4.20	4.15

Sources: Scotiabank Economics, Bloomberg.

The Provinces

(annual % change except where noted)

Real GDP	CA	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
2010–19	2.2	1.1	2.1	1.2	0.7	1.9	2.3	2.2	2.3	2.6	2.9
2021	5.3	1.0	8.4	5.9	5.3	6.7	5.4	1.3	-0.7	4.6	7.1
2022	3.8	-1.7	2.9	2.9	1.1	2.5	3.9	3.3	6.0	5.0	3.8
2023e	1.2	-2.5	2.2	1.3	1.3	0.0	1.2	1.3	1.6	2.2	1.6
2024f	1.2	1.8	2.0	1.4	1.2	0.7	1.1	1.1	1.4	2.2	1.1
2025f	2.1	2.6	2.3	1.7	1.5	1.8	2.1	1.8	2.0	2.6	2.2
Nominal GDP											
2010–19	4.0	3.7	4.2	3.0	2.8	3.8	4.1	3.9	3.5	3.7	4.5
2021	13.4	18.5	14.9	10.0	10.9	11.6	9.8	9.2	13.9	24.9	15.8
2022	11.8	6.8	9.3	7.1	7.4	8.4	9.2	8.6	29.1	22.0	11.0
2023e	2.8	-3.7	5.1	4.3	4.0	3.7	4.3	4.1	-1.2	-2.3	4.6
2024f	4.4	5.7	5.0	4.1	4.1	3.6	3.9	3.7	6.0	6.6	4.2
2025f	4.0	3.5	4.7	3.6	3.6	3.8	4.1	3.7	3.6	3.8	4.2
Employment											
2010–19	1.3	0.6	1.5	0.3	0.0	1.2	1.4	1.0	0.9	1.3	2.0
2021	5.0	3.4	4.0	5.6	3.1	4.3	5.2	3.7	2.6	5.4	6.2
2022	4.0	4.4	5.4	3.6	2.8	3.0	4.6	3.2	3.5	5.2	3.2
2023	2.4	1.8	5.7	2.6	3.5	2.3	2.4	2.5	1.8	3.6	1.6
2024f	1.5	2.4	4.5	2.4	2.0	0.9	1.2	1.6	1.8	2.9	1.9
2025f	1.9	1.3	3.0	2.0	2.0	1.5	1.9	1.7	1.9	2.5	2.0
Unemployment Rate (%)											
2010–19	6.9	13.3	10.6	8.7	9.4	7.1	7.0	5.6	5.3	6.2	6.2
2021	7.5	13.1	9.8	8.6	9.2	6.1	8.1	6.5	6.6	8.6	6.6
2022	5.3	11.3	7.6	6.5	7.2	4.3	5.6	4.6	4.7	5.8	4.6
2023	5.4	10.0	7.3	6.3	6.6	4.5	5.7	4.8	4.8	5.9	5.2
2024f	6.2	10.1	7.8	7.4	7.6	5.1	6.8	5.4	5.3	6.3	5.8
2025f	6.5	10.5	8.3	7.7	7.9	5.3	7.0	5.7	5.6	6.7	6.1
Total CPI, annual average											
2010-19	1.6	2.0	1.6	1.7	1.8	1.5	1.9	1.8	1.8	1.7	1.6
2021	3.4	3.7	5.1	4.1	3.8	3.8	3.5	3.2	2.6	3.2	2.8
2022	6.8	6.4	8.9	7.5	7.3	6.7	6.8	7.9	6.6	6.5	6.9
2023	3.9	3.3	2.9	4.0	3.5	4.5	3.8	3.6	3.9	3.3	4.0
2024f	2.6	2.5	2.3	2.7	2.4	2.9	2.6	1.6	1.8	2.8	2.6
2025f	2.2	2.0	2.1	2.1	2.1	2.3	2.2	2.1	2.2	2.3	2.1
Housing Starts (units, 000s)											
2010–19	201	2.2	0.8	4.2	2.7	44	70	6.6	6.0	31	34
2021	271	1.0	1.3	6.0	3.8	68	100	8.0	4.2	32	48
2022	262	2.7	1.2	5.2	3.7	41	87	3.5	2.6	41	24
2023	240	1.0	1.1	7.2	4.5	39	89	7.1	4.6	36	50
2024f	248	1.7	1.1	7.3	4.1	42	89	7.1	4.6	39	52
2025f	260	2.1	1.1	6.6	4.0	51	93	7.9	5.8	39	50
Motor Vehicle Sales (units, 000s)											
2010–19	1,816	33	7	52	42	441	738	56	54	239	199
2021	1,663	29	8	45	38	413	667	50	43	197	203
2022	1,523	24	7	39	34	369	635	45	41	182	181
2023	1,684	27	8	42	38	412	720	50	45	210	205
2024f	1,766	29	8	45	38	418	724	51	45	205	203
2025f	1,796	29	8	46	39	425	736	52	46	209	206
Budget Balances, (CAD mn)											
2020	-327,729	-1,492	-6	-342	409	-7,539	-16,404	-2,124	-1,127	-16,962	-5,507
2021	-90,200	-272	84	339	769	-772	2,025	-704	-1,468	3,915	1,265
2022	-35,322	784	-66	116	1,013	-6,150	-5,863	-378	1,581	11,641	704
2023e	-40,000	-433	-86	40	247	-6,302	-3,000	-1,997	-483	5,234	-5,914
2024f	-39,800	-152	-85	-467	41	-10,998	-9,800	-796	-273	367	-7,911

* NL budget balance in 2019 is net of one-time revenue boost via *Atlantic Accord* .
Sources: Scotiabank Economics, Statistics Canada, CMHC, Budget documents; Quebec budget balance figures are after Generations Fund and before Stabilization Reserve transfers.

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Canada: Demand, output and prices

Canada	2020	2021	2022	2023	2024	2025
	Current prices CAD billion	Percentage changes, volume (2017 prices)				
GDP at market prices	2 220.5	5.3	3.8	1.1	1.0	1.8
Private consumption	1 261.8	5.1	5.1	1.7	1.1	1.9
Government consumption	504.1	5.4	3.2	1.5	1.4	1.6
Gross fixed capital formation	514.8	9.3	-2.4	-3.2	-0.2	1.9
Final domestic demand	2 280.7	6.1	2.8	0.5	0.9	1.9
Stockbuilding[1]	- 11.1	0.8	2.3	-1.0	-0.1	0.0
Total domestic demand	2 269.6	6.9	5.2	-0.5	0.7	1.8
Exports of goods and services	654.5	2.7	3.2	5.7	2.1	1.8
Imports of goods and services	703.5	8.1	7.6	1.0	1.0	1.8
Net exports[1]	- 49.1	-1.8	-1.4	1.6	0.4	0.0
Memorandum items						
GDP deflator	_	7.7	7.7	1.6	2.9	2.0
Consumer price index	_	3.4	6.8	3.9	2.4	2.1
Core consumer price index[2]	_	2.4	5.0	3.9	2.6	2.1
Unemployment rate (% of labour force)	_	7.5	5.3	5.4	5.9	5.7
Household saving ratio, net (% of disposable income)	_	10.2	5.2	5.4	5.9	5.3
General government financial balance (% of GDP)	_	-2.9	0.1	-0.6	-0.7	-0.6
General government gross debt (% of GDP)	_	119.0	102.0	103.5	103.9	104.1
Current account balance (% of GDP)	_	0.0	-0.4	-0.6	0.2	0.2

1. Contributions to changes in real GDP, actual amount in the first column.
2. Consumer price index excluding food and energy.
Source: OECD Economic Outlook 115 database.

StatLink https://stat.link/vtzwmf

Country Data