STATE OF ALASKA

THE REGULATORY COMMISSION OF ALASKA

Before Commissioners:

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In the Matter of the Tariff Filing Designated as TA127-692 and TA132-692 Filed by WASTE CONNECTIONS OF ALASKA, INC.	))))	U-20-002
In the Matter of the Tariff Filing Designated as TA90-731 Filed by ALASKA WASTE MAT-SU, LLC d/b/a ALASKA WASTE	))))	U-20-003
In the Matter of the Tariff Filing Designated as TA115-667 Filed by ALASKA WASTE-INTERIOR, LLC d/b/a ALASKA WASTE	))))	U-20-004
In the Matter of the Tariff Filing Designated as TA92-714 Filed by ALASKA WASTE-KENAI PENINSULA, LLC d/b/a ALASKA WASTE	))))	U-20-005
In the Matter of the Tariff Filing Designated as TA49-502 Filed by ALASKA WASTE-DENALI, LLC	))))	U-20-006
In the Matter of the Tariff Filing Designated as TA52-653 Filed by ALASKA WASTE-JUNEAU, LLC	))))	U-20-007

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In the Matter of the Tariff Filing Designated as) TA44-654 Filed by ALASKA WASTE-DUTCH) HARBOR, LLC)	U-20-008
In the Matter of the Tariff Filing Designated as) TA42-655 Filed by ALASKA WASTE-NOME,) LLC)	U-20-009
In the Matter of the Tariff Filing Designated as) TA46-656 Filed by ALASKA WASTE-) KETCHIKAN, LLC)	U-20-010

PREFILED REPLY TESTIMONY OF DR. CLEVE B. TYLER

I.   Introduction and Background

1. Q. Please state your name and business address for the record.

   A. My name is Cleve B. Tyler. My business address is 1800 M St., NW, Second Floor, Washington, D.C. 20036.

2. Q. By whom are you employed and in what capacity?

   A. I am a Managing Director at Berkeley Research Group, LLC in the firm's Washington DC office. Berkeley Research Group, LLC ("BRG") is a leading global strategic advisory and expert consulting firm that provides independent advice, data analytics, authoritative studies, expert testimony, investigations, and regulatory and dispute consulting to Fortune 500 corporations, financial institutions, government agencies, major law firms, and regulatory bodies around the world.

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3. Q. Are you the same Cleve B. Tyler who previously submitted Prefiled Direct Testimony in these dockets?

    A. Yes, I am. I provided Prefiled Direct Testimony dated December 23, 2019.[1]

    An updated listing of my qualifications is provided in my CV, which is attached to this testimony as Exhibit CT-R1.[2] For the Commissioners' and parties' convenience, I use the same terms in this testimony as defined in my Prefiled Direct Testimony.

    Exhibit CT-R2 provides a detailed description of the process used to download and clean the data used in my analysis.[3] Exhibit CT-R3 provides a full list of companies included in my analysis.[4]

4. Q. What is the purpose of your reply testimony?

    A. Here, I respond to certain issues raised in the Prefiled Testimony of Janet K. Fairchild-Hamilton, dated October 2, 2020.[5] I also discuss the recent Policy Statement issued by the WUTC where it concludes that "it is in the public interest to update the Lurito Gallagher model with

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[1]   Prefiled Direct Testimony of Dr. Cleve B. Tyler ("Prefiled Direct Testimony").

[2]   I use the naming convention "CT-R1", "CT-R2", etc. with an "R" included to indicate Exhibits attached to this Reply testimony, as distinguished from the Exhibits attached to my Prefiled Direct Testimony, which do not include an "R".

[3]   CT-R2 is the same as CT-2 from my Prefiled Direct Testimony except that I correct the instructions for removing outliers from my model, which had previously included debt and equity variables.

[4]   CT-R3 is identical to CT-3 from my Prefiled Direct Testimony.

[5]   Prefiled Testimony of Janet K. Fairchild-Hamilton.

1   current industry data" to be used for rate-regulated waste collection

2   companies in Washington State.[6]

3 ## II. Washington State Comments and December 2020 WUTC Policy Statement

4

5   5. Q. Did you file comments in Washington State related to the WUTC

6   Staff-Proposed DuPont Model?

7   A. Yes, I was hired by the Washington Refuse & Recycling Association

8   ("WRRA") to study the DuPont Model proposed in January 2019 by

9   WUTC staff ("WUTC Staff-Proposed DuPont Model").   Exhibit

10   CT-R4 is the comments I filed (along with my colleague Paul Diver)

11   on October 25, 2019 regarding the WUTC Staff-Proposed DuPont

12   Model.[7]

13

14   6. Q. Did the WUTC address your comments in Washington State after the

15   filing of your Prefiled Direct Testimony in the present matters?

16   A. Yes. In issuing its Policy Statement maintaining the use of the LG

17   Model, the WUTC states that, "[i]n addition to updating the industry

18   data, the Commission finds that the Lurito Gallagher model should be

19   based upon 10 years of operational data for comparable companies that

20

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22   _____

    [6]   Policy Statement Affirming and Updating the Lurito Gallagher Model for

23   Rate Setting for the Solid Waste Collection Companies, In the Matter of the Commission
     Inquiry into Methods for Setting Rates for Solid Waste Collection Companies, Docket TG-

24   131255, Before the Washington Utilities and Transportation Commission, December 3,
     2020, ¶ 18. ("December 2020 WUTC Policy Statement")

25

26   [7]   Tyler, Cleve B. and Paul Diver, Written Comments Regarding
     Recommendation on Methodology for Deriving Operating Ratio for Solid Waste Haulers

27   Submitted on Behalf of WRRA, October 25, 2019, TG-131255, excluding Appendices
     ("Exhibit CT-R4"). Exhibit CT-R4 is the same commentary as JKF-7.

28

provide transportation services."[8]   This sentence references my commentary in Washington State (Exhibit CT-R4), and specifically identifies "BRG Model 1 SICs."

7. Q. How does the data used in "BRG Model 1 SICs" identified in the December 2020 WUTC Policy Statement correspond to the data you propose for use in these proceedings?

    A. The data is identical.[9]

8. Q. How do the regression results from the use of your "BRG Model 1 SICs" identified in the December 2020 WUTC Policy Statement correspond to the regression results you propose for the use in these proceedings?

    A. The results are identical.[10]

9. Q. What approach does Ms. Fairchild-Hamilton propose?

    A. Ms. Fairchild-Hamilton proposes adopting the WUTC Staff-Proposed DuPont Model (including the corresponding data and regression analysis proposed by WUTC Staff).

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[8]   December 2020 WUTC Policy Statement, ¶ 19.

[9]   *See*, Prefiled Direct Testimony, Q/A 13-20 and Exhibit CT-R4, ¶¶ 27-36 and 46-52.

[10]   *Compare* Exhibit CT-R4, ¶ 66, Table 5.1, Specification 1, *with* my Prefiled Direct Testimony, Q/A 27, Table 4. I refer to the regression analysis based on data for the "BRG Model 1 SICs" as "BRG Model 1". *See*, Exhibit CT-R4, ¶ 66, Table 5.1, Specification 1

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10. Q. Does Ms. Fairchild-Hamilton's approach align with the December 2020 WUTC Policy Statement?

A. No. The WUTC Staff-Proposed DuPont Model was initially proposed by WUTC Staff in January 2019, but it was not adopted by the WUTC. The December 2020 WUTC Policy Statement affirms use of the LG Model, updated to use the data from the "BRG Model 1 SICs". The regression results using data from the "BRG Model SICs" match what I have proposed to use in Alaska in my Prefiled Direct Testimony.

III. Overview of Points of Agreement and Disagreement

11. Q. Do you have basic points of agreement with Ms. Fairchild-Hamilton's testimony?

A. Yes. I agree with her description of the "LG Methodology" that is used in Washington State.[11] I agree with some of her description of how the LG Model works.[12] I agree that the primary criticism of the legacy LG Model is that it is based on outdated data from 1968-1977.[13] I agree with Ms. Fairchild-Hamilton that key differences between the WUTC Staff-Proposed DuPont Model and the proposed update to the LG Model (using the "BRG Model 1 SICs" data) include: 1) how the SIC

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[11]   Prefiled Testimony of Janet K. Fairchild-Hamilton, Q/A 44.

[12]   Prefiled Testimony of Janet K. Fairchild-Hamilton, Q/A 45. However, Ms. Fairchild-Hamilton describes "return margin" in her response, which is undefined. Ms. Fairchild-Hamilton describes a "plot" of "return margin" and "Asset Turn Over". However, the regression model does not require plotting of any data. Also, the regression analysis uses a data transformation to natural log (ln) prior to running the regression. For details regarding the regression analysis, *see* my Prefiled Direct Testimony, Q/A 7-8 and Q/A 21-30.

[13]   Prefiled Testimony of Janet K. Fairchild-Hamilton, Q/A 44.

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1   codes were chosen; 2) how outliers were identified; and 3) how the

2   models incorporate capital structure. I agree with her basic description

3   of the Mahalanobis Method I have proposed for determining outlier

4   observations.[14] I also agree with Ms. Fairchild-Hamilton's description

5   of how capital structure works in the LG Model.[15]

6

7   12. Q. Does Ms. Fairchild-Hamilton have certain critiques of your data sample

8   and model results?

9   A. Yes. Ms. Fairchild-Hamilton says that the sample I propose includes

10   anomalies[16] and that the WUTC Staff-Proposed DuPont Model results

11   are more consistent with changes in interest rates and inflation than the

12   LG Model results.[17]

13

14   13. Q. Do these critiques of your data and model results have merit?

15   A. No. As, I discuss in detail below, there are no anomalies in my data

16   nor in the identical data adopted for use in the December 2020 WUTC

17   Policy Statement. This critique fails to consider that each company is

18   not meant to be perfectly comparable to waste collection companies.

19   Instead, the companies in the data are designed to capture aspects of the

20   economics of waste collection such that, in aggregate, the companies in

21   the data sample are a reasonable proxy for the waste collection industry.

22

23

24   [14]   Prefiled Testimony of Janet K. Fairchild-Hamilton, Q/A 54. For a more
detailed description, see Prefiled Direct Testimony, Q/A 16-20.

25   [15]   Prefiled Testimony of Janet K. Fairchild-Hamilton, Q/A 55.

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27   [16]   Prefiled Testimony of Janet K. Fairchild-Hamilton, Q/A 52, p. 40.

28   [17]   Prefiled Testimony of Janet K. Fairchild-Hamilton, Q/A 58, p. 45.

1   Any companies with anomalous results are eliminated by the outlier

2   process I have described previously.[18]

3

4   Also, Ms. Fairchild-Hamilton's claim that the WUTC Staff-Proposed

5   DuPont Model results are more consistent with changes in interest rates

6   and inflation is based on oversimplified *a priori* expectations that are

7   contradicted by substantial empirical evidence, described in detail

8   below.

9

10   **IV.   Data Sources and Comparable Companies**

11   14. Q. Is the source of the data contained in the WUTC Staff-Proposed DuPont

12   Model that is endorsed by Ms. Fairchild-Hamilton the same as the data

13   source you have proposed in "BRG Model 1"?

14   A. No. The WUTC Staff-Proposed DuPont Model is based on data from

15   Compustat, maintained by Standard & Poor ("S&P").[19] The dataset

16   that I have proposed is from Capital IQ, which is also maintained by

17   S&P. There are several advantages in using Capital IQ. First, Capital

18   IQ has a more granular set of SIC Codes than Compustat, which allows

19   for a more precise selection of SIC Codes.[20] Also, Capital IQ has

20   advantages in that it includes an expanded set of companies compared

21   with Compustat, by including information for private companies and

22   public companies that trade on lower exchanges such as Over the

23

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25   _____

         [18] Prefiled Direct Testimony, Q/A 9-10 and Q/A 16-20.
26
         [19] Exhibit CT-R4, ¶ 27.
27
         [20] Exhibit CT-R4, ¶ 43.
28

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Counter ("OTC").[21] Also, the December 2020 WUTC Policy Statement indicates the use of the "Capital IQ database maintained by S&P".[22]

15. Q. Did you modify the sample group for the purposes of the Alaska analysis compared with your BRG Model 1 sample described in your commentary in Washington State, as asserted by Ms. Fairchild-Hamilton?[23]

A. No, as described above, the data for my commentary in Washington State regarding BRG Model 1 and in my Prefiled Direct Testimony are the same. Figure 1, below (which replicates Figure 2 from my Prefiled Direct Testimony), shows the breakdown of the 164 companies by 2-digit SIC code downloaded from S&P's Capital IQ.[24] These 164 companies are prior to the elimination of outliers as well as any observations with zero or negative values for PM or ATO.
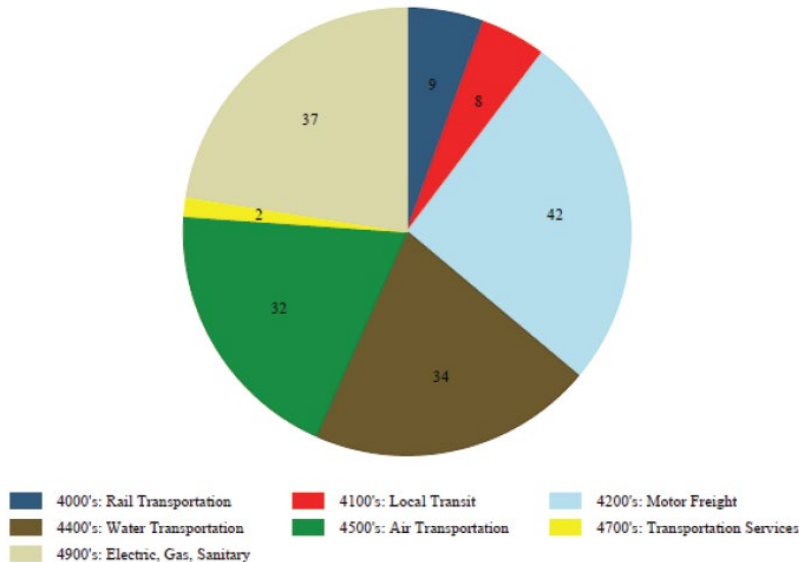
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[21]   Exhibit CT-R4, ¶ 27.

[22]   December 2020 WUTC Policy Statement, ¶ 19. ("The Commission concludes that it is in the public interest to update the Lurito Gallagher model with current industry data from the Capital IQ database maintained by S&P.")

[23]   Prefiled Testimony of Janet K. Fairchild-Hamilton, Q/A 52. ("It appears that Dr. Tyler modified the sample group for the purposes of his Alaska analysis.")

[24]   Prefiled Direct Testimony, Q/A 14. ("[C]ompanies that share the basic economic problem of moving goods (or people) from point A to point B, do so with the use of vehicles, and include similar characteristics regarding logistics (including scheduling and interfacing with infrastructure), use of fuel, and use of drivers/pilots.") These 164 companies reflect additional selection criteria outlined in Exhibit CT-R2 including: 1) removal of observations with missing EBIT, PPE, or Revenue; 2) the removal of duplicate observations; 3) the inclusion of only public and private companies; 4) the inclusion of only companies that are headquarters in the US; and 5) and the inclusion of only companies that have at least one observation for at least one year over the period 2009-2018.

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FIGURE 1
Number of Companies by SIC Code
Used in Model (2009-2018)

Legend:
- 4000's: Rail Transportation
- 4100's: Local Transit
- 4200's: Motor Freight
- 4400's: Water Transportation
- 4500's: Air Transportation
- 4700's: Transportation Services
- 4900's: Electric, Gas, Sanitary

16. Q. Why are there only 129 companies listed in Exhibit CT-R3 instead of 164 companies as in Figure 1, above?

   A. The 129 companies listed in Ex CT-R3 are those that are used in the regression analysis itself following the elimination of outliers and observations with zero or negative values for PM or ATO.[25]

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[25]   Similarly, Exhibit CT-R4, Attachment 1 lists companies used in the analysis following the elimination of outliers, observations with zero or negative values for PM, Debt/Equity Ratio, or ATO, and observations with missing values for Debt or Equity. This is because Specification 2 of Exhibit CT-R4 (¶ 66, Table 5.1) includes a variable for the Debt/Equity Ratio, and companies without these variables cannot be included in that regression model. Additionally, the Mahalanobis Method I utilize for removing outliers must also account for the inclusion of the Debt/Equity Ratio in Specification 2. This explains the difference between the number of companies from Exhibit CT-R3 and the number of companies from Exhibit CT-R4 (Attachment 1), which are the eight companies identified by Ms. Fairchild-Hamilton. *See* Prefiled Testimony of Janet K. Fairchild-Hamilton p. 17 n. 23.

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17. Q. Does your method provide a reasonably comparable set of companies for the waste hauling industry?

A. Yes. Ms. Fairchild-Hamilton says that she has identified several companies in my sample "that do not appear to be a reasonable comparison for the refuse hauler industry."[26] However, this critique of the inclusion of specific companies misses the point. The idea behind choosing SIC Codes which describe economic circumstances facing waste haulers is to capture the economic circumstances for the waste hauling industry generally.[27] This approach means that certain companies may be included which one could argue are not comparable to a waste collection company in some respects – but these companies may capture comparable aspects of waste collection (*e.g.*, logistics). Moreover, making inclusion decisions at the 4-digit SIC level avoids an inherently subjective and laborious company-by-company selection criteria where reasonable analysts might never agree on which companies are appropriate to include.[28]

Ms. Fairchild-Hamilton also questions the sample for including "at least two companies that are no longer operating" and "at least one company that appears to be in bankruptcy".[29] There is no economic reason to eliminate these sorts of companies. The outlier method

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[26] Prefiled Testimony of Janet K. Fairchild-Hamilton, Q/A 52, p. 40.

[27] Prefiled Direct Testimony, Q/A 14.

[28] *See* Prefiled Direct Testimony, Q/A 14.

[29] Prefiled Testimony of Janet K. Fairchild-Hamilton, Q/A 52, p. 40.

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1   employed eliminates observations that are abnormal or unusual without

2   introducing subjective company-specific judgment into the process.

3

4   18. Q. Are there any other differences in the source information that you have

5   proposed ("BRG Model 1" data) versus the data used in the WUTC

6   Staff-Proposed   DuPont   Model   that   is   endorsed   by

7   Ms. Fairchild-Hamilton?

8   A. Yes.   The "BRG Model 1" data incorporates 10 years of data

9   (2009-2018) while the data used in the WUTC Staff-Proposed DuPont

10   Model uses seven years of data (2010-2016).

11

12   **V.   Use of Chow Test Method**

13   19. Q. Does Ms. Fairchild-Hamilton accurately describe the use of the Chow

14   tests in the WUTC Staff-Proposed DuPont Model?

15   A. No.   Ms. Fairchild-Hamilton says that, "…outliers were identified

16   using the Chow method and removed from the proxy group."[30]

17   However, the Chow test is *not* a test for identifying outliers, and nor

18   was it used that way by WUTC Staff. Instead, the Chow test was used

19   by WUTC Staff to determine which SIC codes should be included in

20   the WUTC Staff-Proposed Dupont Model in the first place.

21

22   20. Q. Do you agree with the way the WUTC Staff used Chow tests?

23   A. No.   The use of the Chow test by WUTC Staff was unorthodox,

24   conceptually flawed, and based on circular reasoning that does not

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28   [30]   Prefiled Testimony of Janet K. Fairchild-Hamilton, Q/A 53, p. 41.

1 necessarily lead to a unique set of SIC codes.[31]   That is, two different

2 researchers following the WUTC Staff's proposed Chow test method

3 *using the same data* could arrive at *two different answers* regarding SIC

4 codes to include. The inability to return consistent results renders the

5 proposed   Chow   test   method,   which   is   endorsed   by

6 Ms. Fairchild-Hamilton, unstable and unusable.

7

8 Moreover, the "initial Chow tests conducted prior to the January 2019

9 [WUTC] Staff Proposal are no longer available"[32]. While Chow test

10 analyses conducted by WUTC Staff *after* the January 2019 WUTC

11 Staff-Proposed DuPont Model were disclosed, the SIC codes identified

12 by that later-performed analysis do not match the SIC codes actually

13 specified in the WUTC Staff-Proposed DuPont Model.[33] As such, I am

14 not aware of any underlying support or documentation (using Chow

15 tests or otherwise) which identifies how the SIC codes were chosen for

16 the WUTC Staff-Proposed DuPont Model that is endorsed by

17 Ms. Fairchild-Hamilton.   To my knowledge, such support or

18 documentation does not exist.

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25 [31] S*ee* Exhibit CT-R4, ¶¶ 39-44, providing a more complete description of these inherent problems with the use of a Chow test here.

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27 [32] Exhibit CT-R4, p. 17 n. 23.

28 [33] Exhibit CT-R4, p. 17 n. 23.

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VI.   Outlier Analysis

21. Q. Does Ms. Fairchild-Hamilton address how "incomplete or obviously erroneous data" were removed for data used in the WUTC Staff-Proposed DuPont Model?

A. No. Ms. Fairchild-Hamilton describes that "[i]n the DuPont Model companies with incomplete or obviously erroneous data were removed from the proxy group during UTC staff's initial review."[34] While this statement describes very generally the process that the WUTC Staff described, the WUTC Staff has not indicated in its proposal what criteria were used to identify "incomplete" or "obviously erroneous data".

Though not explicitly mentioned in the WUTC Staff proposal, WUTC workpapers appear to indicate that the "outliers" that are removed are those that "constitute any companies with an ATO of greater than 400 and/or a PM of greater than 100."[35] No description is provided by WUTC Staff or by Ms. Fairchild-Hamilton for why an ATO of 400 and a PM of 100 are appropriate cutoffs. In fact, Ms. Fairchild-Hamilton describes in e-mail correspondence with WUTC Staff that, "…in the industry, an asset turnover ratio ranges from 300 low to a high of around 450 is expected."[36] Moreover, she recognizes that one regulated company in Alaska has an ATO of 1,177, a level she considers

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[34]   Prefiled Testimony of Janet K. Fairchild-Hamilton, Q/A 53.

[35]   Exhibit CT-R4, ¶ 46.

[36]   Exhibit CT-R5, (AG00049 – 052 at 051).

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1   "astounding".[37]   Ms. Fairchild-Hamilton has not explained why she

2   endorses a method proposed by WUTC Staff which departs from the

3   expected ATO range of 300 to 450 which she describes in her email to

4   WUTC Staff. Nor does she explain why it would be appropriate to use

5   a cutoff for ATO of 400, when a regulated entity operates in Alaska

6   with an ATO that is nearly 3-times the cutoff she has endorsed.

7

8   At   a   more   fundamental   level,   the   approach   endorsed   by

9   Ms. Fairchild-Hamilton of using pre-identified cutoffs would adopt a

10   subjective step into the process without sound basis.[38] Using a dataset

11   which has an undefined rationale for eliminating data creates a cloud of

12   uncertainty   around   data   integrity   and   the   integrity   of   the   WUTC

13   Staff-Proposed DuPont Model itself which is based on that data.

14

15   Conversely,   identifying   outliers   using   the   Mahalanobis   Method,   as

16   described in my Prefiled Direct Testimony, provides an objective basis

17   for the elimination of outliers, and is easily implemented.[39]

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25   [37]   Exhibit CT-R5, (AG00049 – 052 at 051).

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27   [38]   *See* Exhibit CT-R4, ¶¶ 37-38.

28   [39]   Prefiled Direct Testimony, Q/A 16-30. *See also*, Exhibit CT-R4, ¶¶ 46-52.

22. Q. Does the WUTC Staff-Proposed DuPont Model endorsed by Ms. Fairchild-Hamilton transform the data for the regression analysis in the same way as the "BRG Model 1"?

A. No. The WUTC Staff-Proposed DuPont Model estimates its regression model using log10 as opposed to natural log (ln).[40] I recommend using natural log (ln), as this transformation of data is far more typical than the use of log 10. The LG Model adopted in Washington State, for example, transforms data using natural log (ln). Given that one goal is to select a model that will be used on a go-forward basis, the use of a recognized, standard approach for data transformation, in my view, is more likely to be accepted than using a non-conventional approach.

VII. Capital Structure

23. Q. Does the assumption embedded in the WUTC Staff-Proposed DuPont Model that the weighted average cost of capital ("WACC") is unrelated to capital structure have empirical support?

A. No. This assumption, which is built into the WUTC Staff-Proposed DuPont Model, lacks empirical support. Ms. Fairchild-Hamilton identifies that the underpinning of the assumption that WACC is unrelated to capital structure is based on the Modigliani-Miller theorem (a theorem originally proposed in two articles in 1958 and 1961).[41] However, the Modigliani-Miller theorem has not been well supported by empirical study over the course of many decades.[42] Dr. Miller

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[40] *See*, CT-R4, ¶ 70. Similar results are found when using either natural log (ln) or log 10.

[41] Prefiled Testimony of Janet K. Fairchild-Hamilton, p. 42 n. 30. *See* Exhibit CT-R4, ¶ 56.

[42] Exhibit CT-R4, ¶¶ 56-62.

himself (of Modigliani-Miller) stated in a review of the theorem after 30 years that, "[d]irect statistical calibration of the goodness of fit of the MM value-invariance propositions has not so far been achieved by us or others for a variety of reasons..."[43] The empirical shortcomings of the Modigliani-Miller theorem have been summarized by M. Vittoria Levati and others.[44]

In addition, a variant to the WUTC Staff-Proposed DuPont Model which explicitly incorporates the Debt-Equity ratio into regression analysis shows empirical support for the proposition that the capital structure of a company *does matter*, as it impacts margins (contrary to the prediction of the Modigliani-Miller theorem) for firms comparable to the waste hauling industry.[45]

Therefore, the assumption built into the WUTC Staff-Proposed DuPont Model that the value of a company is invariant to capital structure lacks empirical support and is contradicted by empirical analysis using data for firms comparable to the waste hauling industry. This represents

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[43]   Merton H. Miller, *The Modigliani-Miller Propositions After Thirty Years*, JOURNAL OF ECONOMIC PERSPECTIVES, 2(4): 99-120, at 103 (1988).

[44] M. Vittoria Levati et al, *Testing the Modigliani-Miller theorem directly in the lab*, EXPERIMENTAL ECONOMICS, 15(4): 693-716, at 694 (2012) ("The opposition to the MM theorem comes from many angles...These studies and, generally, most of the works rejecting the propositions of the MM theorem rely on some kind of market imperfections.") *See also* Gary Charness & Tibor Neubegauer, *A Test of the Modigliani-Miller Invariance Theorem and Arbitrage in Experimental Asset Markets*, THE JOURNAL OF FINANCE, 74(1): 493-529 at 493-494 (2019).

[45]   Exhibit CT-R4, ¶ 66, Table 5.1, Specifications 2 and 4.

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1   another reason why the WUTC Staff-Proposed DuPont Model, and

2   endorsed by Ms. Fairchild-Hamilton, is deficient.

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4   **VIII.   Reasonableness of Models**

5   24. Q. How did Ms. Fairchild-Hamilton evaluate the reasonableness of the

6   two models?

7   A. Ms. Fairchild-Hamilton evaluated the models primarily by studying the

8   ORs and assessing those ORs against what would be predicted by the

9   original WUTC LG model.[46]   This assessment appears to be

10   conditioned on an *a priori* expectation that margins must have declined

11   over time.[47]

12

13   25. Q. Is Ms. Fairchild-Hamilton's apparent *a priori* expectation that margins

14   must be lower today consistent with economic and empirical evidence?

15   A. No. Ms. Fairchild-Hamilton points to the current low-inflation

16   environment and long-term trends in regulated ROE for electric and

17   natural gas utilities as the basis for her comparison of the models.[48]

18   However, basing expectations primarily on allowed ROE for regulated

19   natural gas and electric utilities is potentially problematic. Electric

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21   ────────────────────

22   [46]   Exhibit CT-R6, (AW-AG-1-22). ("Ms. Fairchild-Hamilton used the two
known modifications to the LG model – which is approved by the WUTC for calculating
an OR for refuse hauling – to generate results using Alaska Waste's proposed revenue
requirements. She then compared those results to results from the out-dated [sic] LG model
to determine which of the newer models produced a reasonable result."). *See* identical or
nearly identical language at Exhibit CT-R6, (AW-AG-1-21, AW-AG-1-23, AW-AG-1-28,
AW-AG-1-30, AW-AG-1-33, AW-AG-1-34, and AW-AG-1-35).

26   [47]   Prefiled Testimony of Janet K. Fairchild-Hamilton, Q/A 58. *See also*,
Exhibit CT-R6, (AW-AG-1-36).

28   [48]   Prefiled Testimony of Janet K. Fairchild-Hamilton, Q/A 58.

1 utility companies and natural gas companies are much more capital

2 intensive than waste collection. Moreover, underlying businesses have

3 changed over time. For many electric companies in the lower 48, for

4 example, only the distribution portion of the business is now subject to

5 rate-of-return regulation and the more-risky generation assets may

6 compete without traditional rate regulation. So, expecting that waste

7 collection ROE necessarily follows that of the national trend for electric

8 and natural gas utilities is suspect.

9

10 Fortunately, we can study this issue further – that is, test the *a priori*

11 expectations that Ms. Fairchild-Hamilton appears to use in her

12 assessment of model reasonableness. Frank Reilly conducted an

13 empirical study of the impact of inflation on ROE, using a DuPont

14 model.[49] As part of this analysis, Reilly studied two low-inflation

15 periods (1956-1967 and 1982-1995) against a high-inflation period

16 (1968-1981). Table 2 below replicates his comparisons across these

17 periods.[50]

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25 [49] Frank K. Reilly, *The Impact of Inflation on ROE, Growth and Stock Prices*,

26 FINANCIAL SERVICES REVIEW, 6(1): 1-17 (1997). *See also* Exhibit CT-R4, ¶¶ 17-26.

27 [50] Frank K. Reilly, *The Impact of Inflation on ROE, Growth and Stock Prices*,

28 FINANCIAL SERVICES REVIEW, 6(1): 1-17 at 14.

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TABLE 2 – Replication of Table 4 in Reilly (1997)
Time Period Averages for Stock Returns ROE Components, and Nominal and Real Earnings Growth

	S&P % Total Return	U.S. Inflation % Price Return	Inflation Adjusted S&P 500 % Total Return	TAT	PM	ROA	LEV	ROE	Annual Growth Rate Nominal Earnings	Annual Growth Rate Real Earnings
1956-1967 (12 Years)	11.28	1.97	9.18	1.18	6.12	7.20	1.59	11.45	4.40	2.46
1968-1981 (14 Years)	7.51	7.60	0.08	1.22	5.12	6.28	2.02	12.75	8.11	0.52
1982-1995 (14 Years)	17.01	3.57	13.02	1.04	4.36	4.52	2.96	13.20	5.34	1.80

In the above table, "TAT" is total asset turnover (what we have typically referred to as ATO, measured somewhat differently), "PM" is profit margin, "ROA" is return on assets, "LEV" is leverage defined as assets/equity, and "ROE" is return on equity. The high-inflation period shows margins that are between each of the low-inflation periods. In addition, while "Nominal Earnings" is higher in the high-inflation period, the ROE for the high-inflation period is between each of the low-inflation periods.

Contrary to the *a priori* expectations of Ms. Fairchild-Hamilton, Reilly found that the highest margins were observed during the period with the lowest inflation. In addition, the paper reported a *negative* correlation between margins and inflation which is in stark contrast to the implied *positive* correlation described by Ms. Fairchild-Hamilton.[51] This paper provides no empirical support for a positive relationship

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[51] The paper describes a correlation between margin and inflation of *negative* 0.10, which means that when inflation is higher, company margins tend to be lower, and vice-versa. Frank K. Reilly, *The Impact of Inflation on ROE, Growth and Stock Prices*, FINANCIAL SERVICES REVIEW, 6(1): 1-17 at 13.

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between inflation and margins as Ms. Fairchild-Hamilton suggests would exist.

A similar analysis can be conducted with data for companies from my proposed data sample – which represent reasonable comparable companies for the waste hauling industry overall. Table 3, below, shows the inflation rate, ATO, PM, and ROE for three timeframes: 1969-1981, 1982-2008, and 2009-2018 for my proposed sample of companies comparable to the waste collection industry. This table is designed to study time periods as Reilly did, but to focus on companies comparable to the waste collection industry. The highest margins (12.63%) and highest ROE (15.50%) are observed as occurring during the lowest-inflation period (2009-2018, with inflation of 1.56%).

TABLE 3
High-Inflation and Low-Inflation Averages of
PM, ATO, and ROE for Transportation Companies
BRG Model SICs – No Outlier Filters

	Avg Annual Inflation Rate	ATO	PM	ROE
1968-1981 (14 Years)	7.47	1.00	8.20	8.46
1982-2008 (27 Years)	3.25	1.10	8.23	7.11
2009-2018 (10 Years)	1.56	1.04	12.63	15.50

Note: Asset Turnover Ratio (ATO) is calculated as 100 * total revenue / average PPE. Profit Margin (PM) is calculated as 100 * EBIT / total revenue. Return on Equity (ROE) is calculated as 100 * net income / equity.

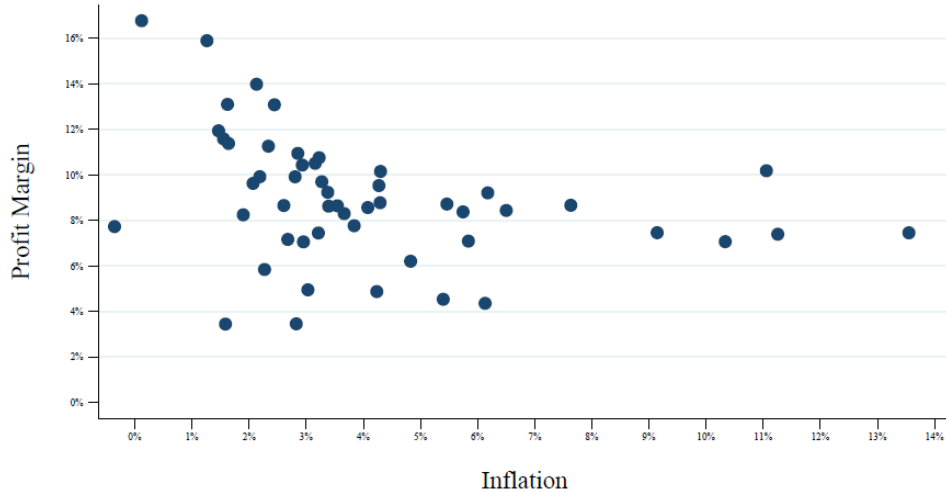Sources: Compustat financial data & FRED economic data.

Using data from my proposed sample of companies comparable to the waste hauling industry, Figure 4 shows a scatterplot of average annual profit margins versus inflation from 1968 to 2018. The correlation

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between PM and inflation for companies comparable to the waste collection industry is negative (-0.323) over this 40-year timeframe.

FIGURE 4

Scatterplot of Average Annual PM & Inflation (1968-2018)
BRG Model 1 SICs - No Outlier Filters
Correlation: -0.323.

Note: Average Annual PM is weighted by revenue.
Sources: Compustat financial data & FRED economic data.

A study of margins, ROE, and inflation does not support the finding of a positive relationship between inflation and margins as Ms. Fairchild-Hamilton assumes must be true.

Changes in macroeconomic conditions, government policies, technology, and industry-specific conditions all have occurred over the last 40-50 years. These all can impact the observed financial performance of an industry and of firms in an industry. In essence, relationships between inflation, margins, and earnings are complex and one cannot easily surmise *a priori* that higher inflation necessarily leads

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to higher margins and/or earnings, or that lower inflation necessarily lowers margins and/or earnings on average.

In fact, based on the empirical observations set forth above, I would expect that a model using data for companies comparable to the waste collection industry would show *increased* margins using more recent data, and not lower margins, as Ms. Fairchild-Hamilton assumes must be true. As the above analyses indicate, Ms. Fairchild-Hamilton's *a priori* expectations are not consistent with economic and empirical evidence, and therefore not an appropriate metric for assessing model reasonableness.

IX.   Summary and Conclusions

26. Q.   Should the WUTC Staff-Proposed DuPont Model that is endorsed by Ms. Fairchild-Hamilton be used in Alaska?

   A.   No, for at least the following reasons – also explained in my responses above:

- the data proposed to be used by WUTC Staff from Compustat is more limited;

- the method proposed by WUTC Staff to select SIC codes is based on a method (Chow method) which has logical irregularities and is not supported by any underlying documentation;

- the outlier method used (eliminating observations with an ATO greater or equal to 400, or PM greater or equal to 100) is subjective and not in line with Ms. Fairchild-Hamilton's understanding of industry norms and with certain observed ATOs in Alaska;

- the WUTC Staff-Proposed DuPont Model transforms data by log-10, which is a non-standard data transformation;

- the WUTC Staff-Proposed DuPont Model includes an assumption of a WACC that is invariant with capital structure – an assumed relationship that does not have empirical support even following decades of study;

- Ms. Fairchild-Hamilton has assessed reasonableness based on an *a priori* expectation of results which is demonstrably inconsistent with empirical evidence over the last 50 years; and

- finally, the December 2020 WUTC Policy Statement does not adopt the WUTC Staff-Proposed DuPont Model, which also is proposed here by Ms. Fairchild-Hamilton, or the underlying data upon which that model is based.

27. Q. What are the advantages of using your proposed sample, as described in your Prefiled Direct Testimony, in conjunction with the LG Model?

A. The advantages of my proposed sample in conjunction with the LG Model include:

- Capital IQ has an expanded set of companies from which data is available compared with Compustat;

- the selection criteria for SIC's are objective and designed to identify a set of companies that face economic circumstances comparable to waste collection companies;

- the proposed Mahalanobis Method to identify outliers is objective, well-recognized (by statisticians), easy to implement, and incorporates the underlying relationship between ATO and PM;

- the data is transformed by natural log (ln), which is a well-recognized and standard practice;

- the LG Model does not incorporate an assumption that WACC is invariant with capital structure, which has not received empirical support; and

- Finally, the data I propose to use in Alaska is identical to the data incorporated by the WUTC in its December 2020 Policy Statement, a statement which also affirms the continued use of the LG Model in Washington State. The regression results using the data affirmed for use by the WUTC in its December 2020 Policy Statement match the regression results that I propose to use in Alaska.

28. Q. Did Ms. Fairchild-Hamilton identify any issues or concerns with your proposed data sample, the regression analysis, or the LG Model that were not addressed in the proceedings in Washington State?

A. No. Ms. Fairchild-Hamilton did not raise any substantive new issues not previously addressed in Washington State. Exhibit CT-R4 addresses the shortcomings of the WUTC Staff-Proposed DuPont Model, including issues with the data selection process and DuPont Model itself. My critiques of the WUTC Staff-Proposed DuPont Model made in Exhibit CT-R4 also apply to the endorsement of that model and the proposal by Ms. Fairchild-Hamilton that the RCA adopt the WUTC Staff-Proposed DuPont Model for Alaska.

29. Q. Does this conclude your testimony?

A. Yes, it does. I reserve the right, however, to provide additional reply testimony to modify my opinions if additional information becomes available to me.

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EXHIBIT CT – R1
CURRICULUM VITAE OF CLEVE TYLER

Curriculum Vitae

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SUMMARY

Cleve B. Tyler, PhD, is a managing director at BRG who specializes in applying economic analyses to antitrust, intellectual property, and damages issues. An economic consultant with more than twenty years of experience, Dr. Tyler also teaches, writes, and speaks about competition and intellectual property topics. He has testified at deposition and trial in federal court, in state court, and at arbitration. Dr. Tyler is an adjunct professor of economics in Johns Hopkins University's applied economics program, teaching graduate-level courses in industrial organization and microeconomics.

Dr. Tyler has developed or analyzed damages models for a range of matters including antitrust, unfair competition, patent infringement, trade secret misappropriation, copyright infringement, breach of contract, breach of fiduciary duty, fraud, and evaluation of class certification issues. His competition and antitrust work include evaluation of both horizontal and vertical issues and analysis of market definition, market power, and competitive effects using regression analysis and economic modeling. Dr. Tyler has analyzed economic and damages issues in many industries, including waste collection and disposal, pharmaceuticals, medical devices, biotechnology, semiconductors, memory products, telecommunications, data products and services, enterprise software, online search advertising, video games, insurance, healthcare, avionics, automotive and automobile components, home appliances, food and beverages, food ordering and delivery platforms, and electricity generation and distribution.

Dr. Tyler holds a PhD in economics specializing in industrial organization, finance, and the economics of the public sector. He is an author of the book *Assets and Finance: Calculating Intellectual Property Damages*, published by Thomson-Reuters, and authored a chapter on expert testimony admissibility in prior versions of this book (annually 2010-2020). He has published articles on damages and competition issues, including in *Antitrust*, *Antitrust Bulletin*, and *The Global Competition Review.* Dr. Tyler is editor-in-chief of *BRG Review* and a member of the American Economic Association and American Bar Association.

EDUCATION

PhD, Economics	Clemson University
BA, Economics	University of Virginia

PROFESSIONAL EXPERIENCE

Berkeley Research Group
Managing Director (January 2018–present)
Director (December 2014–2017)
Principal (December 2010–2014)

Johns Hopkins University
Adjunct Professor of Economics (2010–present)

LECG
Senior Managing Economist (2006–2010)
Managing Economist (2003–2005)
Senior Economist (2001–2002)

Economic Analysis LLC
Economist (1998–2000)

Clemson University
Instructor, Microeconomics and Macroeconomics (1996–1998)
Teaching Assistant, Microeconomics and Macroeconomics (1995–1996)
Research Assistant for Robert E. McCormick and Michael T. Maloney (Fall 1996)

Electric Lite
Economic Consultant and Director of Business Development (1997)

General Accounting Office: Resources, Community, and Economic Development Division
Intern (Summer 1995)

Strategic Analysis Inc.
Analyst (Summer, 1990–1993)

TESTIMONY and EXPERT REPORTS

* *Bobby's Country Cookin', LLC. et. al. v. Waitr Holdings, Inc.*, 2:19-cv-00552-TAD-KK. Provided opinions regarding whether damages could be evaluated on a class-wide basis for breach of contract, breach of duty of good faith and fair dealing, and unjust enrichment claims related to food ordering and delivery platform. (Expert Report)

* *Kingston Technology Corporation, et. al. v. SPEX Technologies*, C.A. No. 8:16-CV-01790. Provided opinions related to claimed patent misuse (assertion of allegedly unenforceable patent) in alleged market for secure portable USB memory products including evaluation of market definition, market power, and competitive effects. (Expert Report and Deposition Testimony)

- Prefiled Direct Testimony before The Regulatory Commission of Alaska *In the Matter of the Joint Revenue Requirement and Cost of Service Study of Alaska Waste Interior, LLC. d/b/a Alaska Waste, Filed as TA115-667 for the Fairbanks North Star Borough Service Area* (as well as for matters *TA127-692, TA92-714, TA90-731, TA52-653, TA44-654, TA42-655, TA46-656, TA49-502*). Provided testimony proposing a rate setting model for appropriate operating margins for solid waste collection companies in Alaska. (Written testimony)

- *ChanBond, LLC. v. Atlantic Broadband Group, LLC.*, U.S. District Court, Delaware, C.A. No. 1:15-cv-00842-RGA. In patent infringement matter, opined regarding royalty base (the number of purchased and/or deployed cable modems and number of monthly subscriptions of high-speed data services) as well as the relationship between price and speed (Mbps) using regression analyses. (Expert Reports and Deposition Testimony) Related matters with same plaintiff and scope for the following defendants:

  - *Bright House Networks, LLC.*, District Court, Delaware, C.A. No. 1:15-cv-00843-RGA. (Expert Reports and Deposition Testimony)

  - *Cable ONE, Inc.*, District Court, Delaware, C.A. No. 1:15-cv-00844-RGA. *Cablevision Systems Corporation and CSC Holdings, LLC.*, District Court, Delaware, C.A. No. 1:15-cv-00845-RGA. (Expert Reports and Deposition Testimony)

  - *Cequel Communications Holdings I, LLC.*, District Court, Delaware, C.A. No. 1:15-cv-00846-RGA. (Expert Reports and Deposition Testimony)

  - *Charter Communications, LLC.*, District Court, Delaware, C.A. No. 1:15-cv-00847-RGA. (Expert Reports and Deposition Testimony)

  - *Comcast Corporation and Comcast Communications, LLC.*, District Court, Delaware, C.A. No. 1:15-cv-00848-RGA. (Expert Reports and Deposition Testimony)

  - *Cox Communications, Inc.*, District Court, Delaware, C.A. No. 1:15-cv-00849-RGA. (Expert Reports and Deposition Testimony)

  - *Mediacom Communications Corporation*, District Court, Delaware, C.A. No. 1:15-cv-00850-RGA. (Expert Reports and Deposition Testimony)

  - *RCN Telecom Services, LLC.*, District Court, Delaware, C.A. No. 1:15-cv-00851-RGA. (Expert Reports and Deposition Testimony)

  - *Time Warner Cable, Inc.*, District Court, Delaware, C.A. No. 1:15-cv-00852-RGA. (Expert Reports and Deposition Testimony)

- ➢ *WaveDivision Holdings, LLC.*, District Court, Delaware, C.A. No. 1:15-cv-00853-RGA. (Expert Reports and Deposition Testimony)

- ➢ *WideOpen West Finance*, LLC., District Court, Delaware, C.A. No. 1:15-cv-00854-RGA. (Expert Reports and Deposition Testimony)

- *Signature Pharmaceuticals, LLC. v. Ranbaxy Pharmaceuticals, Inc.*, American Arbitration Association, Case No. 01 16 004 6534. Estimated damages related to alleged breaches of contract and breach of fiduciary duty with regard to sales of liquid metformin and solid metformin pursuant to joint venture agreement. (Expert Report and Arbitration Testimony)

- *MobilizeGreen, Inc. v. The Community Foundation for the National Capital Region, et al.*, Superior Court of the District of Columbia, C.A. No. 14-005764. Evaluated damages related to alleged lost business opportunities for nonprofit organization allegedly due to breach of contract and breach of fiduciary duty, and provided opinions related to reliability of damages estimate. (Expert Reports and Written Testimony)

- *Waste Management of Louisiana, LLC. v. River Birch, Inc. et al.,* U.S. District Court, Eastern District of Louisiana, Case No. 11-2405. Provided rebuttal testimony regarding damages related to RICO allegations and closure of construction and demolition (C&D) landfill used in the clean-up of debris in the aftermath of Hurricane Katrina. Provided rebuttal testimony regarding damages related to RICO allegations and claimed diverted waste from municipal solid waste (MSW) landfill. (Expert Report, Written Testimony, and Deposition Testimony)

- *Digital Recognition Network, Inc. v. Accurate Adjustments, Inc. et al.*, U.S. District Court, Northern District of Texas, C.A. No. 4:14-CV-00903-A. Opined on relevant antitrust market, monopoly power, competitive effects, and damages issues regarding vertical restraints in sale of Automated License Plate Recognition (ALPR) solutions in case involving trade secret misappropriation. (Expert Report)

- *Apotex, Inc. and Apotex Corp. v. UCB, Inc. and Kremers Urban Pharmaceuticals, Inc.*, U.S. District Court, Southern District of Florida, C.A. No. 12-60706 (DMM). Analyzed and opined on a reasonable royalty for a manufacturing process for pharmaceutical products based on trade secrets. (Expert Report and Deposition Testimony)

- *William Brody v. Village of Port Chester, et al.*, U.S. District Court, Southern District of New York, Case No. 00 CIV 7481 (HB). Estimated damages related to the loss of right to appeal the taking of property pursuant to New York's eminent domain law. (Expert Report, Written Testimony, Deposition Testimony, and Trial Testimony)

SELECTED EXPERT CONSULTING EXPERIENCE

Intellectual Property and Damages

- *Genentech v. Amgen* – Reasonable royalty for patent infringement involving manufacturing process and method of treatment for biosimilar products (two cases involving Avastin and separately, Herceptin)

- *Caltech v. Apple and Broadcom* – Reasonable royalty base and valuation of technology related to allegations of patent infringement involving Wi-Fi patents allowing for faster data transmission

- *Acceleration Bay v. Electronic Arts* – Reasonable royalty for patent infringement involving technology related to network architecture and operation of video games

- *Bombardier Recreational Products, et al v. Arctic Cat – Reasonable* royalty for patent infringement involving technology related to snowmobile engines

- *Samsung Electronics v. NVIDIA Corporation, et al.* – Reasonable royalty and base for patent infringement involving technologies related to the manufacture and operation of semiconductors (including related to Wi-Fi)

- *ContentGuard v. Amazon et al.* – Reasonable royalty and base for patent infringement involving technology related to digital rights management

- *Starhome v. AT&T Mobility, Roamware, and T-Mobile* – Reasonable royalty and base for patent infringement for a technology related to international cell phone roaming

- *In Re Qimonda AG Bankruptcy Litigation* – Economic implications of allowing discontinuance of patents of insolvent firm in the semiconductor industry

- *Callaway Golf Company v. Acushnet Company* – Lost profits, reasonable royalty, and base associated with patents related to golf ball technology

- *Commissariat a L'Energie Atomique v. Chi Mei Optoelectronics, AUO, et al.* – Reasonable royalty and base for alleged infringement of patents related to liquid crystal display (LCD) monitors

Antitrust - Competition

- Retained to estimate price effects using regression analysis related to alleged collusion and bid rigging in the broiler chicken industry

- *In Re: Dealer Management Systems Antitrust Litigation* – Analysis of damages from alleged anticompetitive exercise of market power in data integration services related to provision of software applications to automobile dealerships

- *Quenneville et al. v. Audi, BMW, Mercedes-Benz, Porsche, and Volkswagen* – Evaluation of class certification and damages issues related to alleged conspiracy by automakers to limit competition in quality of vehicles, and to mislead consumers regarding quality of vehicles

- *In Re: Niaspan Antitrust Litigation* – Reverse payment settlement between branded pharmaceutical companies and potential generics under Hatch-Waxman regulations – competitive effects and valuation of ancillary deals including value of a no authorized generic clause ("no-AG clause")

- *Beltran v. Interexchange, et al.* – Evaluation of class certification, merits, and damages issues related to proposed class of au pair alleging collusion and unfair labor practices regarding payment of weekly stipend

- *Avnet and BSP Software v. Motio* – Claims of patent misuse in provision of version control for business intelligence software – market definition, monopolization, and competitive effects

- *Massimo v. Mindray* – Claims of patent misuse, exclusive contracts, and tying in alleged markets and submarkets related to pulse oximetry – market definition, market power, vertical restraints and competitive effects

- *Plaza 22 v. Waste Management of Louisiana* – Class certification in markets for small container commercial waste collection – market definition and common impact

- *First Data Merchant Services Corporation v. Security Metrics* – Competitive effects from provision of security standard compliance for merchants in the payment card industry – market definition, market power, and competitive effects

- *Sanger Insurance Agency v. HUB International* – Claims related to contracts between preferred broker and carriers in the provision of professional liability insurance – market definition, market power, competitive effects from vertical restraints, efficiencies, and damages

- *MM Steel v. Reliance Steel & Aluminum* – Claims related to contracts between steel producers and steel service centers – market definition, market power, and competitive effects from vertical restraints

- Litigation related to exclusive contracting in the provision of fitness benefits to Medicare Advantage plans – market definition, monopoly power, and competitive effects related to vertical restraints

- FTC and EU Commission investigations regarding claims of monopolization and abuse of a dominant position in the provision of specialized search advertising – econometric models to investigate competitive effects using big data, survey design, and remedies

- *In Re: K-Dur Antitrust Litigation* – Reverse payment settlement between branded pharmaceutical companies and potential generics under Hatch-Waxman regulations – market definition, market power, competitive effects, and valuation of ancillary deals

- *Harrill et al. v. Reagan National Advertising of Austin* – Claims related to contractual provisions related to billboard leases – market definition, market power, raising rivals' costs, and damages

- *Coca-Cola v. Sugar Sweet Syrup* – Vertical restrictions related to sales of fountain beverages by retail outlets – market definition, market power, competitive effects, and damages

- *Fraser v. Major League Soccer* – Claims related to single-entity structure of sports league including - evaluation of financial structure of organization

- *Universal Avionics v. Rockwell Collins* – Claims involving flight control systems and flight management systems for regional and corporate aircraft – Evaluation of damages from alleged tying behavior

Antitrust – Mergers

- Merger of companies involved in the provision of customer relations management software and data used in CRM software – market definition, monopolization, and competitive effects including impacts on innovation

- Canadian Competition Bureau investigation into merger of companies selling gasoline at wholesale and retail – market definition and potential unilateral and coordinated competitive effects in 14 alleged markets

- DOJ investigation into merger in the avionics industry – market definition, horizontal and vertical effects, and evaluation of potential for raising rivals' costs

- *Commissioner of Competition v. Tervita* – Merger in the hazardous waste industry in British Columbia (Canadian Bureau of Competition litigation) – market definition, monopoly power, competitive effects using econometric analyses, and efficiencies

- FTC investigation into merger in the coffee industry – market definition (including econometric analysis), market power, vertical competitive effects, and efficiencies

- *FTC v. Polypore* – Consummated merger and monopolization in the battery separator industry (FTC investigation and litigation) – market definition, competitive effects, efficiencies, and remedies

- DOJ investigation into merger in the waste collection and disposal industries – market definition, competitive effects (horizontal and vertical), efficiencies, and remedies

- FTC investigation into merger in the video game industry – market definition and competitive effects

- *DOJ v. Oracle* – Merger involving financial management and human resource management enterprise software products (DOJ litigation) – market definition and competitive effects

- *Texaco v. Dagher; Shell Oil v. Dagher* – Joint venture between oil refiners - evaluation of appropriate competition authority oversight

Damages and Finance

- Retained to build model to predict municipal solid waste and waste recovery volumes based on demographic variables and trends

- Retained to evaluate host fees paid to municipalities by waste industry companies with disposal assets

- *Blairgowrie Trading v. Allco Finance Group Ltd.* – Syndicated loan availability and cost for company operating on certain relevant sectors, including transportation (aviation, rail, shipping), energy, commercial real estate, and wholesale financial services

- *Ameritox v. Millenium Laboratories* – Evaluated claims of unfair competition, false advertising, and unfair trade practices in provision of confirmatory urine drug testing for pain management health care practitioners

- Retained to analyze length of stay by guests at hotel accused of violating the California Civil Code regulating residential hotels

- *Chechele v. Tom Ward and Sandridge Energy* – Recoverable profit resulting from insider trading pursuant to Section 16(b) of the SEC Act

- *Abu Dhabi Investment Authority v. Citigroup* – Damages model using event study analyses related to misrepresentation claims in banking industry

- *Caterpillar v. Navistar* – Alleged breach of contract and alleged fraud associated with an agreement to sell fuel injectors for use in diesel engines – estimation of damages

- Damages involving marketing programs in selling genetically modified soybeans and herbicides

- Value of a right of first refusal for season ticket holders following relocation of sports team

- Analysis of matched and manipulative stock trading

Energy and Regulation

- Retained to evaluated regulated rate methodology in the waste collection industry

- Claimed manipulative trading of energy derivative products – econometric evaluation of electricity prices

- Wholesale electricity prices – evaluation of competitive reasonableness of 2006 Illinois auction

- Claims that an artificial price in electricity forward markets was created through spot market actions and information dissemination

- Claims related to sale of electricity in California and the western US during the California electricity crisis – market definition and competitive effects

- Regulatory proposal for a locational installed capacity market (LICAP) in New England – market power, generator availability, shape of the demand curve, and role of historical capacity levels

- Analyses of California electricity crisis (transmission constraints, calculation of rebates under various scenarios, and trading practices of electric power generators during 2000 and 2001)

PUBLICATIONS

"United States Overview," in The Handbook of Competition Economics 2021, Global Competition Review, with Henry J. Kahwaty. (Prior editions: 2016, 2017, 2018, 2019, and 2020).

Assets and Finances: Calculating Intellectual Property Damages, 2020-2021 edition, with Gregory Smith, West Publishing, Thomson-Reuters.

"Intellectual Property Expert Damages Admissibility," with Deepa Sundararaman, in Assets and Finances: Calculating Intellectual Property Damages, 2019-2020 Edition, by William O. Kerr, and Gregory Smith, West Publishing, Thomson-Reuters. (Prior editions: 2017, authors Richard B. Troxel and William O. Kerr; and 2018).

"Admissibility of Expert Damages Testimony in IP Cases," in Assets and Finances: Calculating Intellectual Property Damages, 2016 Edition, by Troxel, Richard B. and William O. Kerr, West Publishing, Thomson-Reuters. (Prior editions: 2010, 2011, 2012, 2013, 2014, and 2015).

"Canada High Court Breathes New Life Into M&A Efficiencies," *Law360*, February 6, 2015, with Henry J. Kahwaty.

"Market Definition – Achieving an Integrated Analysis," *The Antitrust Bulletin*, 59(3): 667-685, Fall 2014, with Henry J. Kahwaty.

"Measuring Reverse Payments in the Wake of *Actavis*," *Antitrust*, 28 (1): 29-35, Fall 2013, with William O. Kerr.

"Shifting Regulatory Oversight of Utility Mergers" in *Innovating for Transformation: The Energy and Utilities Project*, Montgomery Research, Inc., 2006, with Cliff W. Hamal.

"Market Power Mitigation or Obviation, That is the Question: FERC's Pending Decision on New England's Installed Capacity Market Design," *The Energy Antitrust News*, Winter 2005.

"Renewed Interest in Coordinated Effects in Merger Analysis: The *UPM* Case," *Trade Practices Law Journal*, Summer 2004, with David A. Weiskopf.

Issues in the Deregulation of the Electric Industry. 1998. Clemson University, PhD Dissertation.

"The Wires Charge: Risk and Rates for the Regulated Distributor," *Public Utilities Fortnightly*, September 1997, with Michael T. Maloney and Robert E. McCormick.

PAPERS, COMMENTARY, and CONTRIBUTIONS

"Letter from the Editor," *BRG Review*, Winter 2021 (Volume 8 – containing articles originally published in 2019 and 2020). (Prior volumes: Winter 2018 (Volume 7), Spring 2017 (Volume 6), and Spring 2015 (Volume 5)).

"Written Comments Regarding Recommendation on Methodology for Deriving Operating Ratio for Solid Waste Haulers, Submitted on Behalf of WRRA," Washington Utilities and Transportation Commission, Docket TG-131255,

Inquiry into Methods for Setting Rate for Solid Waste Collection Companies, October 25, 2019, with Paul Diver.

Contributor to Section of Antitrust Law, Antitrust Law Developments (Eighth), American Bar Association, 2017.

"What Drives Physician Testing for Pain Medication Compliance – Risk or Reward?", Working Paper, December 2014, with Robin Cantor, Shireen Meer, Daniel Boada, and Sandra Wetzel, presented by Robin Cantor at Society for Risk Analysis Annual Meeting, Complex Challenges in Health Policy.

Contributor to Selected Readings in Antitrust Economics: Game Theory (VI. Vertical Restraints), American Bar Association, Section of Antitrust Law Economics Committee, May 2014.

"Reasonable Royalty Damages: Expert Testimony and Admissibility," 2014.

"An Economic Evaluation of the Competitive Nature of Reverse Payment Settlements," 2013.

"Analysis of Horizontal Market Power in Transactions Under the Federal Power Act: Comments" with Carl Danner, Henry J. Kahwaty, and Keith Reuter, FERC Docket No. RM11-14-000, May 23, 2011.

Comments for Horizontal Merger Guidelines Review Project, "Comments on Questions 2, 4, and 13," November 9, 2009.

"An Agreement in the Rough: A Modified Cournot Approach to Distribution Agreements," with Ecer, Kahwaty, Nieberding, and Weiskopf. Winter 2006.

"A Plan for Restructuring the Electric Industry in South Carolina," Citizens for a Sound Economy. June 30, 1997, with Michael T. Maloney and Robert E. McCormick.

"Redistribution and Retribution: A Positive Theory of Transfers and Police Expenditures," Public Finance Workshop Paper, Clemson University. December 1996.

"Amtrak: Information on Subsidies in Thruway Bus Operations," General Accounting Office. Resources, Community, and Economic Development Division. May 9, 1995. (major contributor)

PRESENTATIONS

"Effective Intellectual Property Damages Calculation: A Comprehensive Guide," The Knowledge Group, September 30, 2020.

Patent Infringement Mock Trial Damages Expert Testimony - Japanese Intellectual Property Association, Washington, DC, November 12, 2019, (and at previous

events on November 3, 2017; November 6, 2015; November 7, 2013; November 11, 2011; November 13, 2009; and November 9, 2007).

Presentation at Washington Utilities and Transportation Commission Technical Conference, "Inquiry into methods for setting rates for solid waste collection companies", Docket TG-131255, on behalf of Washington Recycling & Refuse Association, with Paul Diver, PhD, October 8, 2019.

"Section 337 Exclusion Orders for New Technology (Mock Hearing on Public Interest for Infringing Biologic Product)," Practitioners' Think-Tank on ITC Litigation & Enforcement, American Conference Institute, June 27, 2019.

"2019 Antitrust Trends, Developments and Legal Issues," The Knowledge Group, April 24, 2019.

"Reverse Payment Settlements: Economic Issues Arising in Antitrust Litigation," The Knowledge Group, August 30, 2018.

"Antitrust Enforcement for Pay-For-Delay Settlements: U.S. and E.U. Perspective," The Knowledge Group, October 20, 2016.

"Merger Analysis: The CCS Case," Clemson University; Clemson, South Carolina; October 18, 2012.

"Quantitative Analysis in Consulting Engagements," University of Virginia; Charlottesville, VA; September 7, 2012; with Anthony D'Andrea.

"A Discussion of the Rolls Royce Decision and Expert Testimony," BRG – Washington, DC, July 2011 with Keith Reutter.

"Capacity Market Design Fundamentals," EUCI conference workshop, Baltimore, MD; October 27, 2010, with Cliff Hamal and Julie Carey.

"Merger Analysis in the Waste Industry – Republic and Allied," University of Virginia; Charlottesville, VA, October 21, 2010, with Paul Diver.

"Critical Elements of Ancillary Services Market Design," EUCI conference workshop, Minneapolis, MN; June 18, 2010, with Scott M. Harvey.

"An Analysis of Reverse Payments in the Pharmaceutical Industry – An Antitrust Topic," Charlottesville, VA; September 25, 2008.

"Market Design Choices for Ancillary for Ancillary Services Products," workshop at EUCI conference, Minneapolis, MN; September 12, 2007, with Cliff Hamal.

"Reliability, Ancillary Service Markets and Scarcity Pricing," presented at EUCI conference, Minneapolis, MN; September 11, 2007; authored by Scott M. Harvey.

"Daubert and Economic Experts," Mock Daubert Hearing, LECG Summer Seminar Series, July 9, 2003.

Presentation before the Public Service Commission of South Carolina on behalf of Citizens for a Sound Economy, Hearings on Electricity Deregulation, August 1997.

ACTIVITIES, HONORS, and AWARDS

- American Economic Association (2001–present)
- American Bar Association (2004–present)
- Editor-in-Chief, *BRG Review* (2015–present)
- Who's Who Legal: Competition Leaders, Economists 2020
- Who's Who Legal: Competition Future Leaders, Economists 2019
- Signatory of Panmure House Declaration, at The New Enlightenment: Reshaping Capitalism and the Global Order in a Neo-Mercantilist World (2019)
- Co-Office Director for BRG's Washington DC office (2015–2017)
- United States Association for Energy Economics (2009–2017)
- International Association for Energy Economics (2009–2017)
- American Health Lawyers Association (2014–2015)
- WCEE (2009–2010)
- Close Fellowship (1994–1996)
- Macaulay Award for Outstanding Performance by a Graduate Student in Economics (1993–1994)
- Earhart Fellowship (1993–1994)

EXHIBIT CT – R2
DATA DOWNLOAD AND PROCESSING

I. CAPITAL IQ DATA DOWNLOAD

A. Summary

1. The regression models rely on data sourced from Capital IQ. This section outlines the process for downloading these data. The following screening criteria are applied to the data system:

    i. SIC Codes: Division E: Transportation, Communications, Electric, Gas, And Sanitary Services (Primary)

    ii. Geographic Locations: United States of America (Primary)

    iii. Total Revenue (Max - 51 Years) [CY 2018] ($USDmm, Historical rate): is greater than 0

2. After applying these filters, the following additional fields are selected:

    i. Excel Company ID

    ii. SIC Codes (Primary Code Only)

    iii. SIC Codes (Primary)

    iv. Company Type

    v. Company Status

    vi. Total Revenue

    vii. EBIT

    viii. Net Property, Plant and Equipment

    ix. Cost of Goods Sold

    x. Net Income

    xi. Total Liabilities

    xii. Total Equity

    xiii. Total Assets

3. This process is discussed in more detail in the following sections.

B. Accessing Capital IQ Company Screening

4. Log into the S&P Capital IQ Platform Log In page.

5. Once logged in, hover over the "Screening" panel on the top bar. Next, click on "Companies" under the "Screening" tab located on the upper left of the pop-up.

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6. This will lead to the "Company Screening" page.

C. Criterion 1 – Industry Classification

7. The first step is to filter the full Capital IQ database by industry. Find the "Company Details" box on the left side of the screen. Next, click on "Industry Classifications" which is found in the "Company Details" box.

8. This will load the "Screening Criteria: Industry Classifications" section at the top of the page. Click on the "Use SIC Code tree" hyperlink located to the right of the "Clear" button in order to access the Standard Industrial Classification (SIC) Codes.

9. This will load all SIC Codes segmented by Division. There will be 10 divisions starting from "Division A: Agriculture, Forestry, and Fishing" to "Division J: Public Administration."

10. Select "Division E: Transportation, Communications, Electric Gas, and Sanitary Services." In Capital IQ, "Division E: Transportation, Communications, Electric Gas, and Sanitary Services" will have all industry SIC codes that start with the "4."

11. In the lower right corner of the "Company Screening" box, click "Add Criteria."

12. The first query will appear at the top of the page, returning the number of companies that are in Division E industries.

D. Criterion 2 – Geographic Locations

13. To further filter companies, select companies headquartered in the United States. To do this, go back to the "Company Details" box on the left side of the page, which is where "Industry Classifications" were found. Click on "Geographic Locations."

14. This will load the box "Screening Criteria: Geographic Locations." Click the plus-sign next to the "United States and Canada" box, then check the "United States of America" box.

15. Click "Add Criteria" at the lower right corner of the box. This will now have 2 criteria for SIC Codes and Geographic Locations which will return a smaller set of companies.

E. Criterion 3 – Financial Information

16. To filter this list of companies further, companies whose revenues were greater than 0 at least once in the chosen time period will be selected. Locate the "Financial Information" box on the left side of the screen.

17. Click on "Financial Statements" which will be the first option available in the box. This will load all different financial data items that Capital IQ provides. Capital IQ provides data from both Capital IQ and Compustat. Data sourced from both Capital IQ and Compustat will be pulled separately through this process.

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18. Expand the "CIQ Financial Statements" option using the "+" button next to it. This will pull up different financial statements options such as the Income Statement, Balance Sheet, and Statement of Cash Flows. To separately pull Compustat data, repeat this step and select "Compustat Financials" instead.

19. Expand the "Income Statement" option by clicking the "+" button. This will bring up all income statement line items available such as Total Revenue, R&D Expense, Operating Income, and other fields.

20. As mentioned above, the next step will be to filter this list of companies by revenue data availability. Revenue is chosen as it is the top line item in the income statement; if revenue data is unavailable, it is highly likely that other financial data items will be unavailable as well for a company. Click on "Total Revenue" under the "Income Statement" section.

21. To only select companies whose revenue is greater than 0, click on the "Aggregates" button on the upper panel of the right box.

22. In the "Metric" drop down, click on "Maximum". Next, go to the "Time Frame" option by selecting the drop down for the number of years of data to be pulled. Select "Enter Value" in the dropdown, and type "51" for the number of years that will be pulled for this search. In the "As of" option, click on the bubble next to "CY" (Calendar Year) and set it to 2018. Lastly, go to the "Value ($mm)" option and type in 0 in the box to the right of the "Greater than" box.

23. Click "Add Criteria" at the lower right corner of the box. There will now be 3 criteria for SIC Codes, Geographic Locations, and Total Revenue Data Availability which will return a smaller set of companies.

F. **Selecting the Data Fields – Accessing "Customize Display Columns"**

24. Above the "SIC Codes" query at the top of page will be a bar that currently highlights the "View Criteria." To the right of it, click on the option to "Customize Display Columns."

25. This will lead to a new page with different boxes to choose from. These are all the options available in Capital IQ to display data fields for your query.

G. **Data Fields 1 – Codes and Identifiers**

26. Locate the "Company Details" box on the left side of the "Customize Display Columns" page.

27. Click on "Codes/Identifiers" in the "Company Details" box which will return Capital IQ's complete set of company identifiers in the in the "Available Items" box. For this search, "SIC Codes (Primary Code Only)," "SIC Codes (Primary)," and "Excel Company ID" will be selected, as these fields will give us the 4 digit SIC code, SIC description for the SIC code, and a unique company identification provided by Capital IQ respectively.

28. Click on each one of these fields one by one and press the single right arrow button ("\>"). The items will have moved from the "Available Items" box to the "Selected Items" box on the right. Click on the "Add Columns" button in the lower right corner.

29. There will now be 6 items in the Company Screening.

H. Data Fields 2 – Company Type and Company Status

30. Go back to the Company Details box and click on "General Business Details."

31. For this search, "Company Type" and "Company Status" will be selected. "Company Type" tells us whether a company is private or public, while "Company Status" can tell us whether a company is a subsidiary.

32. Click on each one of these fields one by one and press the single right arrow button ("\>"). The items will have moved from the "Available Items" box to the "Selected Items" box on the right. Click on the "Add Columns" button in the lower right corner.

33. There will now be 8 items in the Company Screening.

I. Data Fields 3 – Financials

34. Locate the "Financial Information" box in the center of the screen of the "Customize Display Columns" page.

35. Click on "Financial Statements" which will be the first option in the box. This will show both Capital IQ ("CIQ") and Compustat data.

36. Expand the "CIQ Financial Statements" option using the "+" button next to it. This will pull up different financial statements options such as the Income Statement, Balance Sheet, and Statement of Cash Flows.

37. Expand the "Income Statement" option by clicking the "+" button. This will bring up all income statement line items available such as Total Revenue, R&D Expense, Operating Income, and other fields. For this search, "Total Revenue," "Cost of Goods Sold," "EBIT," and "Net Income" fields will be pulled from the Income Statement.

38. Click on "Total Revenue" and the "Display" options box will be populated with multiple options and toggles.

39. Go to the "Display Range" option and click the drop down for number of years, which will be set to 1 as the default. Click on "Enter Value" and type in 51, for the number of years, in the box next to it.

40. Next, click on the bubble below Last 51 years, and select the second drop down in this option which will already be preset to 2019. Select "Enter Value" and set it to 1968. Next, select the third drop down in this option which will be preset to 2019.

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Set this to 2018. As a result, this will display Total Revenue from Calendar Years 1968 to 2018.

41. Click on the "Add Columns" button in the lower right corner. As a result, there will now be "Total Revenue" data fields from Calendar Years 1968 to 2018.

42. Repeat **Steps 34-41** for "Cost of Goods Sold, ", "EBIT," and "Net Income."

43. From the Balance Sheet, "Net Property Plant and Equipment," "Total Liabilities,", "Total Equity," and "Total Assets," will be selected. As a result, expand the "Balance Sheet" option in the "Financial Statements" box by clicking the "+" button.

44. Find "Net Property, Plant, & Equipment" item, and click on this. Repeat **Steps 34-41.**

45. Repeat **Steps 34-41** for "Total Liabilities," "Total Equity," and "Total Assets."

46. To separately pull Compustat data, repeat the steps in this section, selecting "Compustat Financials" instead.

J. Export

47. Once all the financials are selected, click on the "View Results >>" box in the lower right corner.

48. This will lead to the "Company Screening Results Screen" page.

49. Next to the "Screening Settings" icon, in the top left part of the screen, click on the Excel icon that exports this dataset to Excel. This will take some time to generate the workbook. A pop up will come up with the loading screen.

50. Once the dataset has finished downloading at 100%, click on the download button, and your Excel workbook will appear.

II. DATA PROCESSING

A. Transformation

51. The CIQ data is presented in a "wide" format such that there is a different variable for each year-financial variable combination. Thus, the level of observation is the company level. Transform the data to "long" format such that there is a single variable for the year and the level of observation is the company-year level.

B. Filtering and Calculation of Fields

52. The following steps are taken, in order, after transforming the raw data in preparation of the regression model.

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53. Remove any observation that has a missing value in any of the following fields: EBIT, PPE, or revenue.

54. Remove any duplicate companies from the data by manually reviewing company names. When duplicates are identified, only one entry for each company-year is be kept. The following process is used:

    i. If one duplicate has more years of data than the other(s), only that duplicate is kept.

    ii. If there are N duplicates and N-1 of the companies are subsidiaries of the non-subsidiary, only the non-subsidiary is kept.

    iii. When it is not clear which duplicate company should be kept, keep the company with the highest total revenue.

55. The IDs for the companies that have been removed from the Capital IQ data used in these analyses are listed below.

i.	IQ1236048	xvii.	IQ555725368
ii.	IQ1579389	xviii.	IQ328874
iii.	IQ4935625	xix.	IQ243169350
iv.	IQ273513334	xx.	IQ3040966
v.	IQ298968	xxi.	IQ413909753
vi.	IQ3053303	xxii.	IQ610501
vii.	IQ2908516	xxiii.	IQ3114038
viii.	IQ1035237	xxiv.	IQ4176500
ix.	IQ22183895	xxv.	IQ285932557
x.	IQ28448	xxvi.	IQ409424
xi.	IQ428613487	xxvii.	IQ30232680
xii.	IQ30547	xxviii.	IQ862497
xiii.	IQ179862	xxix.	IQ169142
xiv.	IQ2203069	xxx.	IQ650516
xv.	IQ4027729	xxxi.	IQ26
xvi.	IQ4233224		

56. Limit to only public and private companies.

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57. Limit to only companies with headquarters in the United States.

58. Limit to the appropriate range of ten years.

59. Limit to the appropriate set of SIC codes (vehicle transportation companies).

60. Calculate each company-year's PPE as the average of PPE_t and PPE_{t-1}. If the period t-1 does not exist for a given company-year, simply use PPE_t for that observation.

61. Calculate profit margin as EBIT divided by revenue, multiplied by 100.

62. Calculate asset turnover as revenue divided by PPE, multiplied by 100.

63. Calculate the Mahalanobis distance for each observation on the basis of profit margin and asset turnover. Filter out any observation with a Mahalanobis distance greater than the 95th percentile value of a chi-squared distribution with two degrees of freedom (approx. 5.991).

64. The data is now ready to run through the regression model, which transforms the profit margin and asset turnover to the natural log form.

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EXHIBIT CT – R3
COMPANIES INCLUDED IN MODEL

Companies Included in Model

Advanced Disposal Services, Inc. (NYSE:ADSW)	Mouser Electronics, Inc.
Air Methods Corporation	NRC Group Holdings Corp. (AMEX:NRCG)
Air T, Inc. (NasdaqGM:AIRT)	New Century Transportation, Inc.
Air Transport Services Group, Inc. (NasdaqGS:ATSG)	Norfolk Southern Corporation (NYSE:NSC)
AirTran Holdings, LLC	Norwegian Cruise Line Holdings Ltd. (NYSE:NCLH)
Alaska Air Group, Inc. (NYSE:ALK)	Old Dominion Freight Line, Inc. (NasdaqGS:ODFL)
Allegiant Travel Company (NasdaqGS:ALGT)	Op-Tech Environmental Services Inc.
Alpine Air Express Inc.	Overseas Shipholding Group, Inc. (NYSE:OSG)
American Airlines Group Inc. (NasdaqGS:AAL)	P.A.M. Transportation Services, Inc. (NasdaqGM:PTSI)
Andes Gold Corporation (OTCPK:AGCZ)	PHI, Inc.
ArcBest Corporation (NasdaqGS:ARCB)	Pangaea Logistics Solutions, Ltd. (NasdaqCM:PANL)
Atlas Air Worldwide Holdings, Inc. (NasdaqGS:AAWW)	Patriot Transportation Holding, Inc. (NasdaqGS:PATI)
Avalon Holdings Corporation (AMEX:AWX)	Perma-Fix Environmental Services, Inc. (NasdaqCM:PESI)
BNSF Railway Company	Pinnacle Airlines Corp.
Baltic Trading Limited	Precicion Trim, Inc. (OTCPK:PRTR)
Bristow Group Inc. (OTCPK:BRSW.Q)	Prestige Cruises International S de R.L.
Burlington Northern Santa Fe, LLC	Principal Maritime Tankers Corporation
C.H. Robinson Worldwide, Inc. (NasdaqGS:CHRW)	Providence and Worcester Railroad Company
CSX Corporation (NasdaqGS:CSX)	Quality Distribution Inc.
Carnival Corporation & Plc (NYSE:CCL)	R3 Treatment Inc.
Casella Waste Systems, Inc. (NasdaqGS:CWST)	Rand Logistics, Inc.
Celadon Group, Inc. (OTCPK:CGIP)	Republic Airways Holdings Inc.
Choice Environmental Services, Inc.	Republic Services, Inc. (NYSE:RSG)
CitiWaste, LLC	Ridgebury Crude Tankers LLC
Clean Harbors, Inc. (NYSE:CLH)	Royal Caribbean Cruises Ltd. (NYSE:RCL)
Commercial Barge Line Company	Rural/Metro Corporation
Covenant Transportation Group, Inc. (NasdaqGS:CVTI)	SCI Engineered Materials, Inc. (OTCPK:SCIA)
Daseke, Inc. (NasdaqCM:DSKE)	SEACOR Holdings Inc. (NYSE:CKH)
Delta Air Lines, Inc. (NYSE:DAL)	SEACOR Marine Holdings Inc. (NYSE:SMHI)
Diamond S Shipping Group, Inc.	SIRVA, Inc.
Dorian LPG Ltd. (NYSE:LPG)	Safety-Kleen, Inc.
Eagle Bulk Shipping Inc. (NasdaqGS:EGLE)	Saia, Inc. (NasdaqGS:SAIA)
Emerald Waste Services, LLC	Schneider National, Inc. (NYSE:SNDR)
EnergySolutions, Inc.	Seven Seas Cruises S. DE R.L.
Envision Healthcare Corporation	Sharps Compliance Corp. (NasdaqCM:SMED)
Era Group Inc. (NYSE:ERA)	SkyWest, Inc. (NasdaqGS:SKYW)
FedEx Corporation (NYSE:FDX)	Southwest Airlines Co. (NYSE:LUV)
Forward Air Corporation (NasdaqGS:FWRD)	Spirit Airlines, Inc. (NYSE:SAVE)
Frontier Group Holdings, Inc.	Stericycle, Inc. (NasdaqGS:SRCL)
Genco Shipping & Trading Limited (NYSE:GNK)	Swift Transportation Company
Genesee & Wyoming Inc. (NYSE:GWR)	TForce Final Mile, LLC
Glenrose Instruments Inc.	TexCom, Inc. (OTCPK:TEXC)
Global Aviation Holdings Inc.	The Providence Service Corporation (NasdaqGS:PRSC)
Gordon Trucking, Inc.	Tidewater Inc. (NYSE:TDW)
Great Lakes Aviation, Ltd. (OTCPK:GLUX)	Trailer Bridge Inc.
Gulfmark Offshore, Inc.	Transport America, Inc.
Hawaiian Holdings, Inc. (NasdaqGS:HA)	U.S. United Ocean Services, LLC
Heartland Express, Inc. (NasdaqGS:HTLD)	U.S. Xpress Enterprises, Inc. (NYSE:USX)
Heritage-Crystal Clean, Inc (NasdaqGS:HCCI)	US 1 Industries Inc.
Hornbeck Offshore Services, Inc. (NYSE:HOS)	US Airways Inc.
Hudson Technologies Inc. (NasdaqCM:HDSN)	US Ecology, Inc. (NasdaqGS:ECOL)
Industrial Services of America, Inc. (NasdaqCM:IDSA)	USA Truck, Inc. (NasdaqGS:USAK)
International Seaways, Inc. (NYSE:INSW)	Union Pacific Corporation (NYSE:UNP)
International Shipholding Corp.	United Airlines Holdings, Inc. (NasdaqGS:UAL)
J.B. Hunt Transport Services, Inc. (NasdaqGS:JBHT)	United Maritime Group LLC
Jack Cooper Holdings Corp.	United Parcel Service, Inc. (NYSE:UPS)
JanOne Inc. (NasdaqCM:JAN)	Universal Logistics Holdings, Inc. (NasdaqGS:ULH)
JetBlue Airways Corporation (NasdaqGS:JBLU)	Virgin America Inc.
Kansas City Southern (NYSE:KSU)	WCA Waste Corporation
Kirby Corporation (NYSE:KEX)	Waste Connections, Inc. (NYSE:WCN)
Knight-Swift Transportation Holdings Inc. (NYSE:KNX)	Waste Management, Inc. (NYSE:WM)
Landstar System, Inc. (NasdaqGS:LSTR)	Werner Enterprises, Inc. (NasdaqGS:WERN)
Marten Transport, Ltd. (NasdaqGS:MRTN)	XPO CNW, Inc.
Matson, Inc. (NYSE:MATX)	YRC Worldwide Inc. (NasdaqGS:YRCW)
Mesa Air Group, Inc. (NasdaqGS:MESA)	

EXHIBIT CT – R4
Written Comments Regarding Recommendation on Methodology for Deriving Operating Ratio for Solid Waste Haulers Submitted on Behalf of WRRA, October 25, 2019, TG-131255, Excluding Appendices

Written Comments Regarding Recommendation on Methodology

for Deriving Operating Ratio for Solid Waste Haulers

Submitted on Behalf of WRRA

October 25, 2019

TG-131255

Inquiry into methods for setting rate for solid waste collection companies

Cleve B. Tyler, Ph.D.[1]

Paul Diver, Ph.D.[2]

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[1] Managing Director at BRG. *See* Appendix A for Curriculum Vita.

[2] Associate Director at BRG. *See* Appendix B for Curriculum Vita.

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Appendix A: Cleve B. Tyler CV

Appendix B: Paul G. Diver CV

Appendix C: Data Download and Processing

Attachment 1: Companies Included in Model 1

Attachment 2: Companies Included in Model 2

Attachment 3: SIC Codes Included in Model 1, Model 2, and Staff DuPont Model

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I.   EXECUTIVE SUMMARY

A. Assignment and Summary

1. We have been asked by Washington Refuse & Recycling Association ("WRRA") to evaluate the Report to the Utilities and Transportation Commission ("WUTC") titled "Recommendation on methodology for deriving operating ratio for solid waste haulers" dated January 16, 2019, and submitted by Danny Kermode, CPA, Assistant Director for Water and Transportation ("January 2019 Staff Report").[3] Our work includes reviewing in detail the proposed methodology contained in that report and developing alternatives to that method for consideration by the WUTC and its staff.

2. Our proposal adheres to the principle of using best practices such that the proposal is logic-based and understandable, uses standard approaches, is reliable and replicable, and is well-documented so future updates can adhere to the method. Overall, the method is designed to provide margins and returns to the regulated solid waste collection companies that are fair, reasonable, and sufficient.

3. The regulated solid waste collections industry in Washington has used a model that has been in in place for several decades which provides a mechanism for the WUTC to use in determining permitted revenues, the LG Model. A growing consensus has emerged that this model is in need of updating, largely due to the fact that the underlying data upon which margins and returns are based is from the period 1968-1977. The WUTC staff has issued a proposal to update both the data and the underlying model which uses this data in determining rates, the DuPont model discussed in the January 2019 Staff Report.

4. The proposed Staff DuPont Model has several positive attributes, such as the underlying premise upon which companies are determined to be comparable, and the general manner in which the data is used for estimating revenues. The use of a regression approach and a model such as DuPont can result in margins and returns that are fair, reasonable, and sufficient. However, there are several attributes of the January 2019 Staff Report and the proposed Staff DuPont Model discussed in that report which can be substantially improved upon.

5. In these comments, we provide a proposal on behalf of WRRA which builds upon the sound and fundamental attributes of the proposed Staff DuPont Model described in the January 2019 Staff Report. We provide alternative approaches for several of the features which do not represent, in our view, a best-practices approach in the Staff DuPont Model.

6. The concept of the DuPont model is to select comparable firms which reflect the inherent underlying economics, and thus face similar risks as the regulated solid waste collection firms. The proposed Staff DuPont Model selects firms that are generally identified as transportation companies. However, the process proposed by Staff incorporates a set of

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[3] We refer to the DuPont model proposed in the January 2019 Staff Report as the "Staff DuPont Model." We refer to the regression analysis proposed by staff as part of the Staff DuPont Model as the "Staff DuPont Regression". We refer to the spreadsheet that is part of the Staff DuPont Model as the "Staff DuPont Spreadsheet".

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filtering techniques which adds a substantial degree of subjectivity. The Staff-proposed techniques are based on a series of statistical tests that are misapplied and logically circular. Importantly, however, if the rule for including firms is a "good" rule, then a complex set of additional rules for excluding entire groups of firms as proposed by Staff is not warranted.

7. We propose two alternative sets of comparable companies which are both consistent with the objectives expressed in the January 2019 Staff Proposal, but without unnecessary filtering processes. The first set of comparable companies we propose are those that provide transportation services using vehicles (information from which are used in our Model 1). The second set of comparable companies we propose are those that provide transportation services, whether using vehicles or not (information from these companies are used in our Model 2). In our view, both of these alternative sets of companies represent a best-practices approach for modeling purposes.

8. Using firms providing transportation services with vehicles (Model 1) has advantages because it is a definition that targets closely the sorts of firms that provide similar services as waste collection companies. The disadvantage is that because it is more targeted, there are fewer companies and data points for the analysis. Using firms providing transportation services (Model 2) has advantages because this definition adds many data points (largely natural gas and pipeline firms), and the resulting predicted margins from the regression model using this data has a similar shape to both the original LG regression and the Staff's proposed DuPont Model. Model 2 is somewhat less targeted than Model 1 in terms of the similarity of firms included in the analysis.

9. Data points from comparable firms are used in a regression analysis.[4] Here, the objective of the regression analysis is to predict a margin based on other characteristics of the data. The Staff DuPont Regression uses the asset turnover ratio as a variable for predicting margins. Then the Staff DuPont Spreadsheet essentially fixes the predicted margins based on a theoretical proposition (the Modigliani-Miller Theorem) which says that firm value (and therefore margins earned) are unrelated to capital structure (Debt/Equity ratio). This is a substantial departure from the approach used in the LG, which effectively finds a ROE following the regression analysis, and then determines the margin sufficient to ensure that ROE regardless of capital structure.

10. The problem with the approach in the Staff DuPont Model is that the Modigliani-Miller Theorem upon which the structure of the Staff DuPont Spreadsheet is based has sparse empirical support. In fact, *many studies* have failed to find support for the theory in the real-world, and many others have pointed to real-world considerations which are ignored in the theorem. Therefore, the theoretical underpinnings of the Staff DuPont Spreadsheet are not well-supported. There certainly are redeeming qualities to the Modigliani-Miller Theorem. However, the empirical shortcomings of the theory simply are too great to be ignored for the purposes of setting rates.

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[4] A regression analysis is a statistical technique that estimates relationships between variables based on the underlying data in the analysis.

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11. We propose a solution to this problem. Let the data show us to what extent the Modigliani-Miller Theorem is operative in this industry. This is accomplished by including Debt/Equity ratio directly into the regression analysis. If the Modigliani-Miller Theorem is at work, the data will tell us so. Our solution also has the advantage of being in line with the original DuPont formula which indicates that PM has a relationship with both asset turnover (ATO) and capital structure (Debt/Equity). We find that when including Debt/Equity in the model, the results are between the original LG (which fixes ROE) and the Staff DuPont Model (which fixes PM).

12. We also propose a standard statistical approach for identifying outliers in the raw data to avoid any one data point substantially influencing the results. This approach (Mahalanobis) takes into account underlying correlations between the variables under study. In contrast, the January 2019 Staff Proposal uses a subjective cutoff without any particular justification.

13. Finally, the Staff DuPont Spreadsheet can be modified to account for corporate income taxes, similar to the way in which the current LG spreadsheet accounts for corporate income taxes. Moreover, if the WUTC decides to continue to use the original LG model, a version of our regression model (without any provision for capital structure) can used as an input in the original LG.

B. Summary of Specific Analytical Steps

14. Based on the principles expressed above, and on the analyses included throughout these comments, a break-down of our specific proposals for the analysis are the following.

  a. Use data from Capital IQ. Capital IQ is a widely-used data source and is expected to be available on a go-forward basis.

  b. Include companies in the analysis which have SIC codes indicating that companies in those codes are principally engaged in transportation. We provide two alternative sets of companies. Model 1 includes SIC codes which describe companies that conduct transportation primarily by the use of vehicles. Model 2 does not include this restriction (and so is a broader set of companies), and is more in line with the January 2019 Staff Report.

  c. Use an outlier detection method (Mahalanobis method) which is a standard statistical approach that is widely recognized as a reliable method which takes into account relationships between multiple variables in determining outlier observations.

  d. Use ten years of data for Model 1 and seven years of data for Model 2. The difference is to ensure that Model 1 has sufficient data for estimation of profit margin.

  e. Use the following regression specification to predict margins:

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$$\ln PM = \alpha + \beta_1(\ln ATO) + \beta_2\left(ln\frac{D}{E}\right) + \varepsilon,$$

where, *PM* is profit margin defined as 100**EBIT/(Net Revenue)*,[5] *ATO* is defined as 100**(Net Revenue)/(Average PPE)*,[6] and *D/E* is defined at 100**(Total Debt)/(Total Equity)*. This regression specification is consistent with the relationships described in the DuPont model, and it allows for the relationship between the capital structure of a firm and margins to be empirically determined rather than by strict adherence to theory. The Staff DuPont Spreadsheet can be modified readily to accommodate D/E ratio as an additional variable in the regression model.

   f. The Staff DuPont Spreadsheet can be modified to account for corporate income taxes, similar to the way in which the current LG spreadsheet accounts for corporate income taxes.

C. Specific Points of Differentiation from Proposed Staff DuPont Model

15. Our proposal differs from the January 2019 Staff Report in several important respects. These key differences include that:

   a. We select SIC codes based upon the economic rationale for their inclusion. The proposed use of Chow tests in the January 2019 Staff Report is especially ill-suited for the SIC selection question at hand. The proposed method contains circular logic and may not lead to a unique solution. If certain observations are inappropriate for use in the analysis, these observations are excluded by the outlier method we describe in our proposal.

   b. The January 2019 Staff Report has cut-offs for outliers at 400 ATO and 100 PM without any particular justification. Our proposed approach (Mahalanobis distance) is widely accepted and takes into account the particular characteristics of the data in determining outlier observations.

   c. The Staff DuPont Spreadsheet imposes a strict relationship between capital structure and margins. In particular, calculated return on equity (ROE) is forced to increase mechanically with increased debt, and decline mechanically with less debt. This design is based on the Modigliani-Miller Theorem regarding firm value and capital structure. However, as we discuss below, the Modigliani-Miller Theorem lacks empirical justification. Instead, we recommend incorporating this capital

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[5] *EBIT* is defined as Earnings Before Interest and Taxes.

[6] *Average PPE* is the average Property Plant and Equipment for a year. Since PPE is reported as a snapshot, the average PPE for 2018 for a company is the PPE for calendar year-end 2017 plus PPE for calendar year-end 2018, divided by 2.

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structure into the model directly to empirically estimate the relationships rather than through strict adherence to theory.

d. The January 2019 Staff Report includes a range of return that intends to provide the WUTC with flexibility in setting rates. However, the metric by which this range is determined (the standard error of the intercept term of the estimated regression model) is misapplied. To the extent the WUTC would like to reward a company or lower margins for a companies, this is better accomplished by changing the allowable expenses and/or investments in the spreadsheet rather than using a range around a single coefficient point estimate from the estimated regression model.

16. Each of our recommendations and departures from the January 2019 Staff Report are discussed in detail below.

II. BACKGROUND AND EXPECTATION OF RESULTS

17. A motivating factor behind the update to the LG model has been to update data used in the modeling to reflect a more recent, lower-inflation period, with the apparent expectation that this would lower earnings for companies. The January 2019 Staff Report *begins* its description of the DuPont Formula Model Results with the statement, "[w]ith the current data in the Lurito Gallagher Model reflecting a high inflationary period, it should be no surprise that the returns provided in staff's proposed DuPont Formula Model are lower."[7] Similar sentiments are expressed in in the Solid Waste Rate Setting Methodology Final Report, dated December 19, 2014 ("2014 Bell Study"):[8]

> A brief comment regarding the impact of inflation is warranted. For the ten-year period (1968-1977) used to estimate the L-G curve, inflation, based on the CPI for urban consumers (all items), averaged 6.4%. In contrast, inflation for the 2011, 2012, and 2013 averaged just 2.2%. Holding other factors constant, this should produce lower nominal returns on equity. At a minimum, the L-G curve(s) should be updated when inflation rates change appreciably.

While the above statement is essentially true – the qualifications are important, namely that "*[h]olding other factors constant*, this *should* produce lower nominal returns on equity."[9]

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[7] January 2019 Staff Report, p. 15. The January 2019 Staff Report also states that, "if inflation becomes a factor in the near future, it would be expected that earnings would start to increase to offset the effects of inflation." (January 2019 Staff Report, p. 13.)

[8] "Solid Waste Rate Setting Methodology" Report Submitted by Bell & Associates, Inc. & Sound Resource Economics, December 19, 2014, Docket No. UG 131255, p. 4.

[9] "Solid Waste Rate Setting Methodology" Report Submitted by Bell & Associates, Inc. & Sound Resource Economics, December 19, 2014, Docket No. UG 131255, p. 4. (emphasis added)

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18. Contrary to the statement above, in reality, when inflation changes other factors are *not held constant*. Businesses experience inflation through increases in input prices – that is, through cost pressures. A business is unsure how much of this cost increase is due to general cost increases and how much is specific to the business (or industry). Pass-through of these cost increases likely will be incomplete and/or delayed. All of these factors put downward pressure on margins, and earnings. Moreover, inflationary periods may occur in more unstable economic environments, putting further pressure on margins and earnings.[10]

19. Reilly (1997) conducted an empirical study of the impact of inflation on ROE, using the DuPont model, the issue we are examining here.[11] As part of this analysis, Reilly (1997) studied two low-inflation periods (1956-1967 and 1982-1995) against a high-inflation period (1968-1981). Table 2.1 below replicates his comparisons across these periods.[12]

TABLE 2.1 – Replication of Table 4 in Reilly (1997)
Time Period Averages for Stock Returns ROE
Components, and Nominal and Real Earnings Growth

	S&P % Total Return	U.S. Inflation % Price Return	Inflation Adjusted S&P 500 % Total Return	TAT	PM	ROA	LEV	ROE	Annual Growth Rate Nominal Earnings	Annual Growth Rate Real Earnings
1956-1967 (12 Years)	11.28	1.97	9.18	1.18	6.12	7.20	1.59	11.45	4.40	2.46
1968-1981 (14 Years)	7.51	7.60	0.08	1.22	5.12	6.28	2.02	12.75	8.11	0.52
1982-1995 (14 Years)	17.01	3.57	13.02	1.04	4.36	4.52	2.96	13.20	5.34	1.80

20. In the above table, "TAT" is total asset turnover (what we have typically referred to as ATO, measured somewhat differently), "PM" is profit margin, "ROA" is return on assets, "LEV" is leverage defined as assets/equity, and "ROE" is return on equity. The high-inflation period shows margins that are between each of the low-inflation periods. In addition, while "Nominal Earnings" is higher in the high-inflation period, the ROE for the high-inflation period is between each of the low-inflation periods.

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[10] Hazlitt, Henry, "Inflation Versus Profits," Foundation for Economic Education, November 1, 1977. https://fee.org/articles/inflation-versus-profits/

[11] Reilly, Frank K. (1997) "The Impact of Inflation on ROE, Growth and Stock Prices," Financial Services Review, 6(1): 1-17.

[12] Reilly, Frank K. (1997) "The Impact of infliction on ROE, Growth and Stock Prices," Financial Services Review, 6(1): 1-17, p. 14.

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21. Reilly (1997) describes that margins and returns were lower during high-inflation periods:[13]

> …[I]t was demonstrated that the critical variable was what happened to ROE, which was determined by what happened to the DuPont components and especially the profit margin during periods of inflation…
>
> The correlation analysis confirmed prior results which showed a negative relationship between stock returns and inflation (stocks are a poor inflation hedge) and between profit margins and inflation which helps explain the stock return results. An analysis of stock returns and ROE results during periods of relatively low inflation (1956-1967 and 1982-1995) versus a period of high inflation (1968-1981) confirms these results because real stock returns were significantly higher during periods of low inflation and there was clearly a higher growth rate of real earnings during periods of low inflation. Finally, the superior returns on stocks during periods of low inflation can be explained by the direct comparison of inflation and implied growth rate of earnings. Specifically, during periods of low inflation the implied growth rate of earnings generally exceeds inflation, while during periods of high inflation, the implied growth rate of earnings is equal to *or less than* the rate of inflation.

22. Reilly found a correlation between margins and inflation of negative 0.10.[14] A review of data specific to the transportation industry also shows negative correlation between inflation and margins. For example, Figure 2.2 shows a scatterplot between inflation and PM by year from 1968 to 2018 using the companies from our proposed Model 1 (discussed in more detail below). Here we see a correlation of negative 0.32. In fact, the years with the largest margins all occur in years with low inflation. Figure 2.3 below shows a corresponding scatterplot using companies from out proposed Model 2 (again, discussed in more detail below). The correlation between inflation and margins over the period 1968 to 2018 for these companies is negative 0.076. We are not claiming that these correlations must be negative. Instead, we are demonstrating that there is little reason to assume that they must be positive.

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[13] Reilly, Frank K. (1997) "The Impact of inflation on ROE, Growth and Stock Prices," Financial Services Review, 6(1): 1-17, pp 15-16. (emphasis in original)

[14] Reilly, Frank K. (1997) "The Impact of infliction on ROE, Growth and Stock Prices," Financial Services Review, 6(1): 1-17, p. 13.

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FIGURE 2.2

Scatterplot of Average Annual PM & Inflation (1968-2018)
BRG Model 1 SICs - No Outlier Filters
Correlation: -0.323.

Note: Average Annual PM is weighted by revenue.

Sources: Compustat financial data & FRED economic data.

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FIGURE 2.3

Scatterplot of Average Annual PM & Inflation (1968-2018)
BRG Model 2 SICs - No Outlier Filters
Correlation: -0.076.
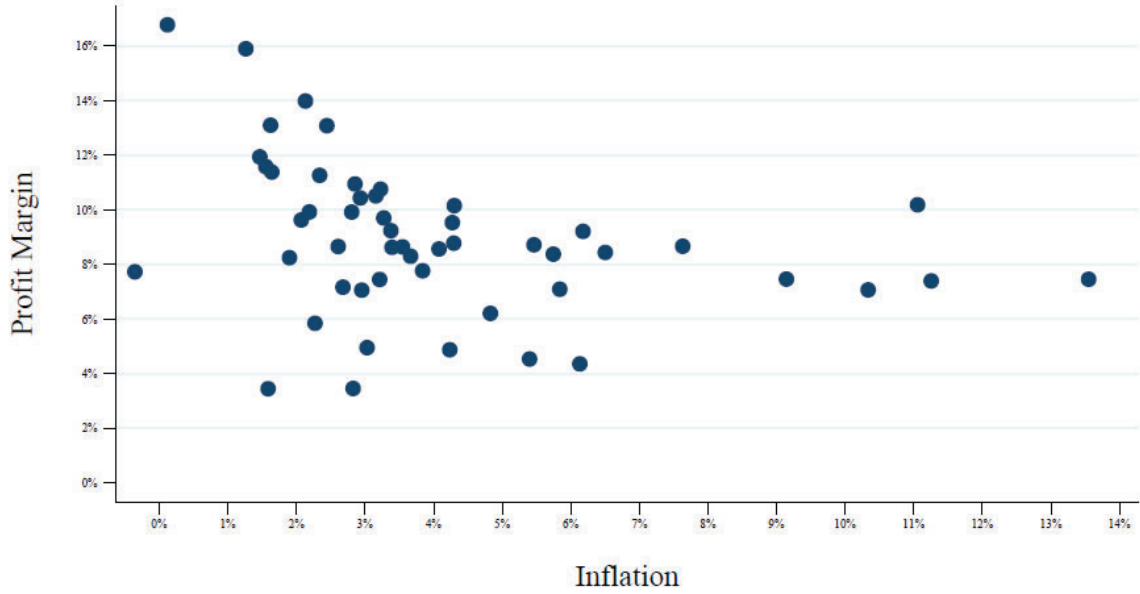
Note: Average Annual PM is weighted by revenue.
Sources: Compustat financial data & FRED economic data.
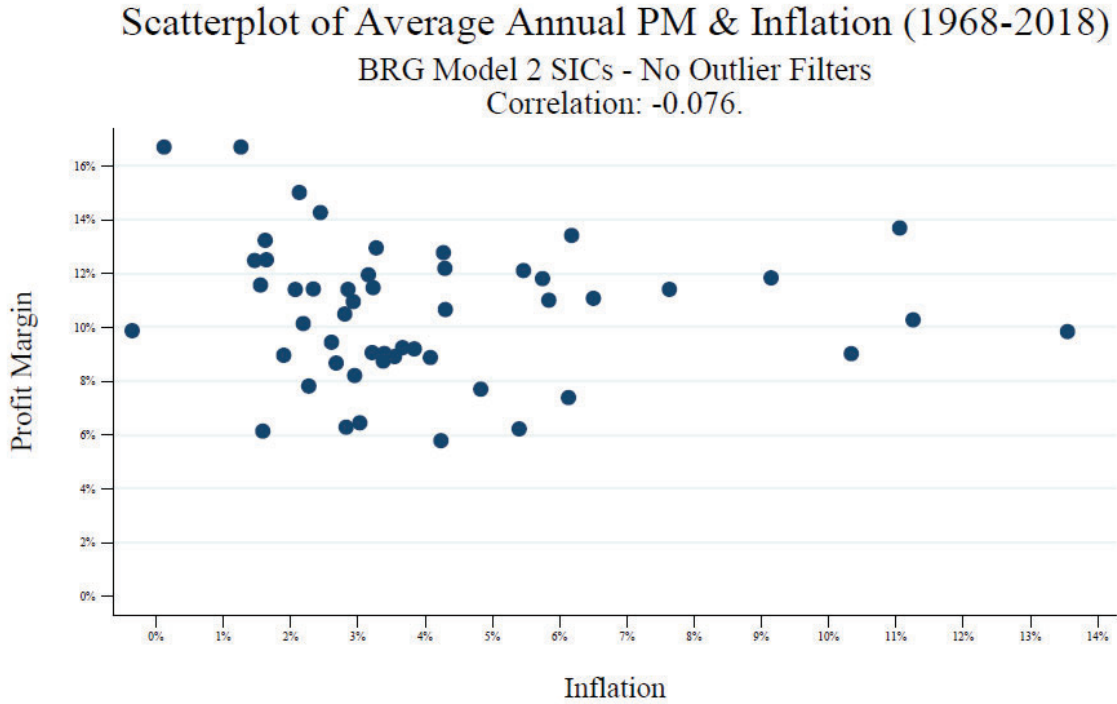
23. The averages that Reilly reports in his paper can be computed using data from the transportation industry. Tables 2.4 and 2.5 below shows ATO, PM, and ROE for the high-inflation period from 1968-1981 (same as Reilly) and during low-inflation periods from 1982-2008 and from 2009-2018, for Models 1 and 2 respectively.

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TABLE 2.4
High-Inflation and Low-Inflation Averages of
PM, ATO, and ROE for Transportation Companies
BRG Model 1 SICs – No Outlier Filters

	Avg Annual Inflation Rate	ATO	PM	ROE
1968-1981 (14 Years)	7.47	1.00	8.20	8.46
1982-2008 (27 Years)	3.25	1.10	8.23	7.11
2009-2018 (10 Years)	1.56	1.04	12.63	15.50

Note: Asset Turnover Ratio (ATO) is calculated as 100 * total revenue / average PPE. Profit Margin (PM) is calculated as 100 * EBIT / total revenue. Return on Equity (ROE) is calculated as 100 * net income / equity.

Sources: Compustat financial data & FRED economic data.

TABLE 2.5
High-Inflation and Low-Inflation Averages of
PM, ATO, and ROE for Transportation Companies
BRG Model 2 SICs – No Outlier Filters

	Avg Annual Inflation Rate	ATO	PM	ROE
1968-1981 (14 Years)	7.47	1.01	10.93	10.90
1982-2008 (27 Years)	3.25	1.03	9.18	7.62
2009-2018 (10 Years)	1.56	0.82	13.57	10.94

Note: Asset Turnover Ratio (ATO) is calculated as 100 * total revenue / average PPE. Profit Margin (PM) is calculated as 100 * EBIT / total revenue. Return on Equity (ROE) is calculated as 100 * net income / equity.

Sources: Compustat financial data & FRED economic data.

24.   In the high-inflation period from 1968 to 1981, the annual inflation rate was nearly 7.5 percent, margins were between 8 and 11 percent, and the measured ROE was also between 8 and 11 percent. In the next 27-year period, inflation was much lower at 3.25 percent on average. Both margins and measured ROE also fell to some extent for Model 2, but rose for Model 1. Additionally, in the most recent 10 years (the period of time recommended

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for Model 1), annual inflation was still lower at about 1.5 percent per year, yet margins exceeded 12.5 percent for both models and ROE exceeded 10 percent for both models.

25. Macroeconomic conditions and industry-specific changes have occurred over the last 40-50 years. These all can impact the observed financial performance of an industry and of firms in an industry. In essence, relationships between inflation, margins, and earnings are complex and one cannot easily surmise *a priori* that higher inflation necessarily leads to higher margins and/or earnings, or that lower inflation necessarily lowers margins and/or earnings.

26. This is not to say that the model should never be updated. Our view is that using recent data will capture the risks inherent to the industry better than outdated information. However, given the myriad factors that can influence margins and returns, one cannot reliably expect to predict how results will change based on the change in just one factor (like inflation) over time.

III.   DATA SOURCE AND COMPARABLE COMPANIES SELECTION

A. Data Source

27. The January 2019 Staff Proposal uses Compustat data from S&P as its data source. Compustat's coverage of financial data is limited in comparison to Capital IQ's data. While Compustat only covers financial data from public companies, Capital IQ provides coverage for both public and private companies. Additionally, Compustat financial data is prioritized based on market capitalization and index constituency, while Capital IQ is able to cover companies that trade on lower exchanges such as the Over the Counter (OTC) markets.[15] S&P does provide sufficient information in its Capital IQ data to perform the analyses discussed in these comments. We recommend using Capital IQ from S&P for the analysis.

28. Appendix C to these comments provides a detailed description of the process used to download and clean the data used in our analysis.[16] We would anticipate that any policy or rule would include detailed instructions for downloading data for use in future updates.

B. Definition of Companies to Include

29. The January 2019 Staff Proposal focuses on developing a "portfolio of comparable companies that arguably all face similar risks inherent to the transportation industry,

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[15] Correspondence with S&P Global. For more information, please see: https://www.capitaliq.com/help/sp-capital-iq-help/website-disclosures/quality-program.aspx.

[16] This includes, for instance, a description for how to remove (what we found to be a small number of) duplicate entries.

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including solid waste collection companies."[17] In particular, "[t]he selection criteria limits the proxy portfolio to companies that load, transport, and deliver, without changing or converting that which is transported."[18]

30.   We agree that developing a portfolio of comparable companies with risks similar to those faced by solid waste collection companies will provide for meaningful analysis for setting rates for solid waste collection companies. Companies are selected by choosing SIC codes rather than assessing inclusion on a company-by-company basis.[19] Any attempt to consider companies individually would invariably lead to subjectivity in the selection process. However, while there can be some "grey areas" in selecting SIC codes, we have found that the alternatives below lead to relatively few "grey areas" in selecting SIC codes for inclusion.[20]

31.   We offer two alternative definitions for identifying the relevant sets of comparable companies.

   a.   Model 1: SIC codes describing companies primarily engaged in transportation with the use of vehicles. *See* Attachment 1 for a list of companies.

   b.   Model 2: SIC codes describing companies primarily engaged in transportation. See Attachment 2 for a list of companies.

Our definitions are quite similar to the definition offered in the January 2019 Staff Proposal, except without the limitations that companies must "load, transport, and deliver" and "without changing or converting that which is transported."[21] Attachment 3 compares the SIC codes available from Capital IQ selected for Model 1 (transportation using vehicles), Model 2 (transportation companies), and for those proposed by staff (taking into account the SIC codes excluded under the January 2019 Staff Proposal, discussed below).

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[17] January 2019 Staff Proposal, p. 10.

[18] January 2019 Staff Proposal, p. 10.

[19] The Standard Industrial Classification (SIC) is a system that classifies industries by a four digit code. The first two digits of the code identify the major industry group, while the third digit identifies the industry group and the fourth identifies the industry.
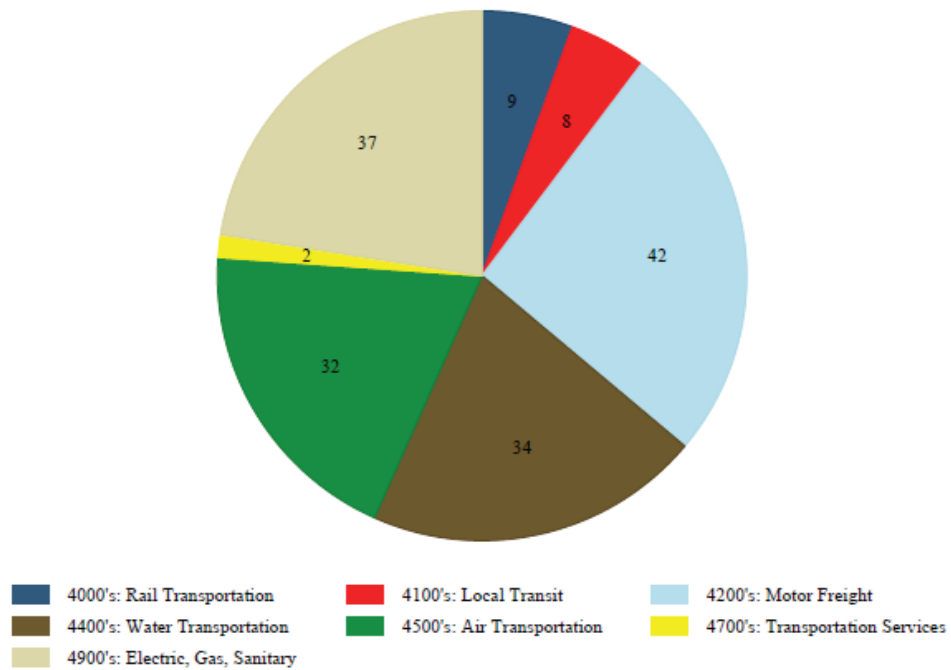
[20] Note that we use SIC codes for this definition, however, the same process can be used for NAICS codes (or some alternative grouping of companies). We focus on SIC codes because the Capital IQ data includes SIC codes by company, but does not provide information on NAICS codes.

[21] Solid waste collection companies actually convert what is delivered by compacting waste, so we found this limitation not particularly meaningful. In addition, an economic conversion of a product can occur just by moving the product. That is, food delivered to my doorstep is "different" than food at the store simply because it is at my doorstep, though it is not physically converted.

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32. The differences in the companies included in Model 1 and Model 2, based on 2-digit SIC codes, are shown in Figures 3.1 and 3.2 below, respectively.

FIGURE 3.1

Number of Companies by SIC Code
BRG Model 1 (2009-2018)

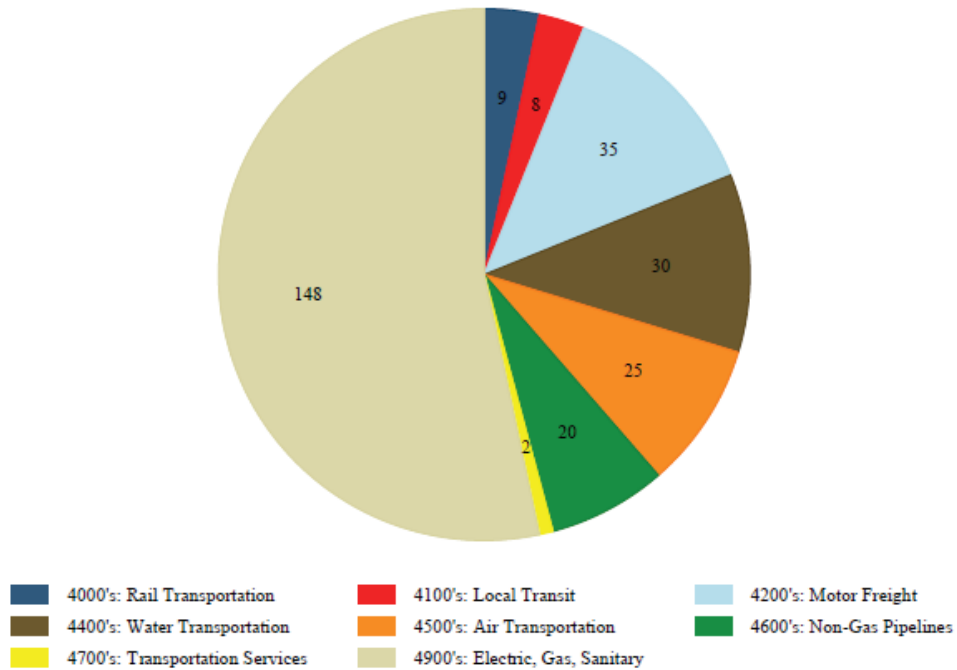|		
■ 4000's: Rail Transportation	■ 4100's: Local Transit	■ 4200's: Motor Freight
■ 4400's: Water Transportation	■ 4500's: Air Transportation	■ 4700's: Transportation Services
■ 4900's: Electric, Gas, Sanitary		

Note: Companies tallied prior to any outlier filtering.

Source: Capital IQ financial data.

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FIGURE 3.2

Number of Companies by SIC Code
BRG Model 2 (2012-2018)

Pie chart legend:
- 4000's: Rail Transportation
- 4100's: Local Transit
- 4200's: Motor Freight
- 4400's: Water Transportation
- 4500's: Air Transportation
- 4600's: Non-Gas Pipelines
- 4700's: Transportation Services
- 4900's: Electric, Gas, Sanitary

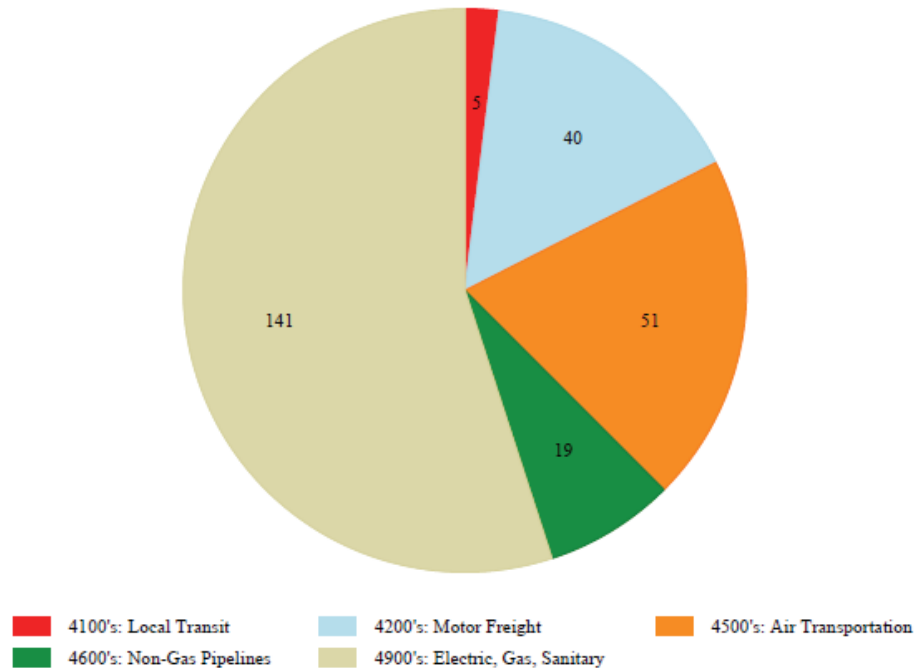Values shown: 9, 8, 35, 30, 25, 20, 2, 148

Note: Companies tallied prior to any outlier filtering.

Source: Capital IQ financial data.

33. The primary differences between the companies in Model 1 and Model 2 is that Model 2 includes pipeline and natural gas companies. Figure 3.3 below shows the breakdown of the companies in the SICs included in the January 2019 Staff Proposal.

FIGURE 3.3

Number of Companies by SIC Code
Staff Model (2010-2016)

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141

4100's: Local Transit

4200's: Motor Freight

4500's: Air Transportation

4600's: Non-Gas Pipelines

4900's: Electric, Gas, Sanitary

Note: Companies tallied prior to any outlier filtering.

Source: Capital IQ financial data.

34. Staff's proposal does not include companies involved in transportation by water or rail, but does include natural gas and pipeline companies and water treatment companies.

35. Model 1 includes all SIC codes involving transportation by vehicle (primarily, transportation by land, air, water, and rail, and waste companies), but not natural gas, pipeline, or water treatment companies. Model 2 includes all companies from Model 1, but also includes pipeline and natural gas companies.

36. In our view, Model 1 provides for a set of companies that approximates the economics and risks inherent to the solid waste collection industry. However, Model 2 also resides within the scope of best practices and represents a viable alternative for conducting the regression analysis. The advantage of Model 2 is that a greater number of observations are available for any particular timeframe (allowing the use of seven years of data instead of ten), and that the slope of the relationships observed using Model 2 are closer to slope of the relationships found in the LG an also the Staff Proposed Regression.

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IV. DATA FILTERS

A. Removal of Data and Staff-Proposed Chow Tests

37. The January 2019 Staff Proposal states that, "[t]o safeguard the integrity of the data, groups with incomplete data or obviously incorrect data were removed during initial review…"[22] However, the January 2019 Staff Proposal does not specifically identify the groups removed or those that have "obviously incorrect data." There is no indication what criteria were used to determine that something was incomplete or incorrect.

38. In our view, additional steps for removing companies – or entire SIC codes - completed "during initial review" add an element of subjectivity into what is meant to be an objective process. Additional steps are unnecessary if the rules for SIC code inclusion discussed in the prior section are based on sound economic reasoning. Rather, we propose that any "obviously incorrect data" would be removed during the outlier removal process, discussed below.

39. In addition, the January 2019 Staff Proposal states that, "[e]ach grouping was also tested statistically using the Chow test to confirm its fitness as a subset in the representative sample."[23] A Chow test is an "F-test" which assesses statistically whether there has been a structural break in the data. That is, are there statistically significant differences in the parameters across the two subsets of the data when compared.[24]

40. Here, we cannot know what datasets to test against each other. The January 2019 Staff Proposal appears to test companies for each SIC code against companies from every other SIC code grouped together. However, when conducting the experiment this way, if anything is removed subsequently, then all other tests conducted were performed against a comparison group that included a removed subset of data.

41. An example is instructive. Assume there are 4 SIC codes named A, B, C, and D. The Chow test method performed in the January 2019 Staff Proposal would test A against the combination of B, C, and D; test B against the combination of A, C, and D; test C against the combination of A, B, and D; and test D against the combination A, B, and C. Assume that the first test showed that A was statistically different compared with B, C, and D. Now all of the other tests are not particularly meaningful, because they each assume A is a valid set of data to be compared against. This suggests an iterative process.

42. However, removing A from each of the other tests might demonstrate additional differences (perhaps now B is different from C and D). Moreover, if additional sets of data

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[22] January 2019 Staff Proposal, pp. 10-11.

[23] January 2019 Staff Proposal, p. 11. We understand that the initial Chow tests conducted prior to the January 2019 Staff Proposal are no longer available. We were provided subsequent analysis by staff performed in support of the January 2019 Proposal consisting of Chow tests for each of the 16 SIC codes (and groupings). Those results indicate that 8 SIC codes were statistically different from the remainder (p-value 1%). However, it appears that only 1 SIC was eliminated from the subsequent regression analysis in the proposed Staff DuPont Model.

[24] Wooldridge, Jeffrey M., Introductory Econometrics: A Modern Approach, Nelson Education, 2016, pp. 223, 406.

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are removed, data subset A may no longer be statistically different from the remaining group of SIC codes, if retested. In short, we don't know what to test against what, leading to a circular process that is not guaranteed to result in a unique or stable outcome.

43. There are additional issues. The results depend on the definition of the codes considered in the analysis. Some SIC codes for companies are at the 2-digit level, some at the 3-digit level, and some are at the 4-digit level, depending on what information is recorded by S&P. In fact, the Capital IQ dataset has a more granular set of SIC codes for companies than does Compustat. This suggests an entirely different set of information included in an analysis based on Chow tests that would be driven mostly by the granularity of the data available from the data provider.

44. Overall, the use of a Chow test here does not make sense conceptually. We would expect different SIC codes to have some differences between them. In fact, we *want* to include those differences so long as they are capturing different elements of the economic circumstances faced by solid waste collection companies – such that rejecting a group of SIC codes might be eliminating a certain type of risk that is partially applicable to waste collection.

45. This is not to say that we want to keep all data points in all circumstances. Any data points that are sufficiently distinct as to potentially impact the relationships estimated in the regression analysis can be identified through the detection of outliers, discussed in the following section.

B. Outlier Methodology – Mahalanobis Method

46. The January 2019 Staff Proposal states that it removes "companies that constituted extreme outliers."[25]   The workpapers subsequently provided show that these "extreme outliers" constitute any companies with an ATO of greater than 400 and/or a PM of greater than 100. Companies with a negative ATO or negative PM are also removed in the January 2019 Staff Proposal (as these observations cannot be transformed to log form).

47. Extreme data, atypical observations in the model calibrating data, can have a profound influence on the regression model describing the relationship between the variables under consideration. However, simply because a given data point appears extreme, that does not mean that it is actually extreme in terms of the statistical relationship between the variables involved. Accordingly, it is important to distinguish those data which are atypical of the data distribution in a rigorous statistical manner.[26]

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[25] January 2019 Staff Proposal, p. 11.

[26] Note that this is not to say that data should not be visually inspected, as visual inspection can provide important information to a researcher about data characteristics. However, a best practices approach for outlier determination is not to select outlier based on visual inspection, which can lead to error, especially when well-established statistical methods are available that are not subjective in nature.

48.	In a multivariate setting, one in which there are multiple variables under consideration, each observation is made up of one value for each variable. For example, a single observation for a company has an ATO value, a D/E value, and a PM value. In determining whether an observation is an outlier, a best-practices approach considers not only the values of each individual variable, but also the joint relationship between the variables:[27]

> Multivariate outliers can occur in ... subtle ways. For instance, … a case may be an outlier because the subject is somewhat deviant on several of the variables, although not markedly deviant on any of them…[A] subject may be a multivariate outlier because he(she) is very deviant on one of the variables, or on a few of the variables.

49.	Consideration of this joint relationship in determining outliers is accomplished through the use of a statistical method based on the calculation of the *Mahalanobis distance* for each observation in the data:[28]

> The *Mahalanobis* distance is a well-known criterion which depends on estimated parameters of the multivariate distribution…observations with a large *Mahalanobis* distance are indicated as outliers.

The Mahalanobis distance-based approach is straightforward to implement, yet is quite powerful at incorporating complex relationships between variables under consideration:[29]

> Although the Mahalanobis method seems simplistic at first sight, it is easy to overlook the fact that the Mahalanobis method accounts for the inter-attribute dependences in a graceful way, which become particularly important in high-dimensional data sets. This simple approach turns out to have several surprising advantages over more complex distance-based methods in terms of accuracy, computational complexity, and parameterization[.]

50.	This approach contrasts with any approach that strictly sets thresholds on possible values any single variable can take. As noted, considering variables one at a time fails to incorporate the complex relationships that can occur between variables into the outlier analysis. Taking those relationships into account can have the effect of identifying

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[27] Stevens, James, Applied Multivariate Statistics for the Social Sciences, Lawrence Erlbaum Associates, Publishers, 1986, p. 14.

[28] Ben-Gal, Irad, "Outlier Detection," in Maimon O. and Rockach L., Data Mining and Knowledge Discovery Handbook: A Complete Guide for Practitioners and Researchers, Kluwer Academic Publishers, 2005, § 4.1.

[29] Aggarwal, Charu C., Outlier Analysis, Second Edition, Springer, 2017, p. 53. The formula for calculating Mahalanobis distances for each observation can be expressed as $MD_i{}^2 = (x_i - \bar{x})'S^{-1}(x_i - \bar{x})$, where $MD_i{}^2$ is the Mahalanobis distance for observation i, x_i is the vector of variable values for observation i, $\bar{x}$ is the vector of variable mean values for the observations, and S is the covariance matrix of the variables. Frequently, the Mahalanobis distance is also referred to by name and written in its root form as: $MD_i = \sqrt{(x_i - \bar{x})'S^{-1}(x_i - \bar{x})}$.

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observations as outliers when they might not initially appear to be, and conversely considering a data point as typical of the data distribution despite a large value for a single variable:[30]

> In classical statistics, a univariate outlier is an observation that is far from the sample mean. (Modern statistics use robust statistics to determine outliers; the mean is not a robust statistic.) You might assume that an observation that is extreme in every coordinate is also a multivariate outliers, and that is often true. However, the converse is not true: when variables are correlated, you can have a multivariate outlier that is not extreme in any coordinate!

51. Observations with a large Mahalanobis distance can be identified as outliers and are eliminated from the data.[31,32] Figure 4.1 below demonstrates the concept of the Mahalanobis distance in a bivariate setting.

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[30] Wicklin, Rick. "The geometry of multivariate versus univariate outliers." https://blogs.sas.com/content/iml/2019/03/25/geometry-multivariate-univariate-outliers.html

[31] The method for identifying outliers makes use of distributional properties of the Mahalanobis distance statistic. With a large number of observations, the Mahalanobis distance statistic approximately follows a χ^2 distribution with p degrees of freedom where p is the number of variables considered (*see* Stevens, James, Applied Multivariate Statistics for the Social Sciences, Lawrence Erlbaum Associates, Publishers, 1986, p. 14) which is indeed a skewed distribution.

In the Technical Workshop on October 8th, 2019, we discussed using a two-stage process for the identification of outliers: 1) calculate a Mahalanobis distance for each observation, then 2) apply the Hubert-Vandervieren approach to identify outliers in the resulting skewed distribution of distances. The Hubert-Vandervieren approach accounts for skewness in distributions, and was developed to account for generalized skewness when the distribution itself was unknown. However, the Mahalanobis distance is of a known skewness (χ^2 distribution), so the Hubert-Vandervieren approach with the Mahalanobis distance, while not "wrong", adds an unnecessary step.

Given that ATO, D/E, and PM are log transformed in the regression model, any observation which contains a negative value for any of these three variables is also excluded from the data.

[32] A Mahalanobis distance for an observation is considered large enough to be identified as an outlier if it is above the 95th percentile value (less than a 5% probability of occurring by chance alone) of a χ^2 distribution with p degrees of freedom where p is the number of variables considered. In the present scenario, ATO, D/E, and PM are being considered, so $p = 3$. Stricter cutoffs requiring the probability of a Mahalanobis distance occurring by chance alone to be lower, for example a 1% or a 0.1% probability of occurring, would result in a larger Mahalanobis distance cut-off value and fewer observations being identified as outliers.

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FIGURE 4.1
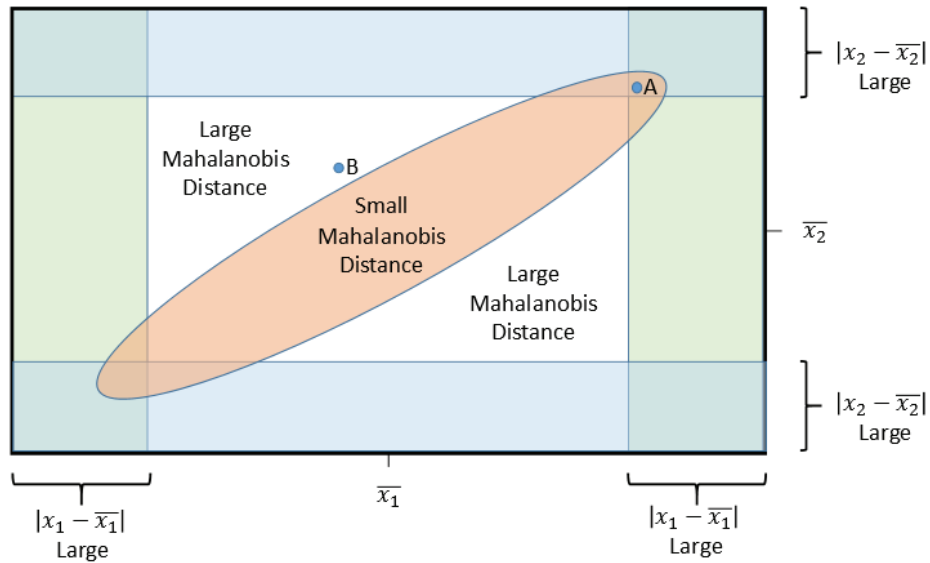
Taking into consideration the relationship between the two variables identifies a circular or oval shaped region of pairs of variable values which would not be considered outliers. In our regression model recommendations, we use three variables, ATO, D/E, and PM.[33] In the context of three variables (rather than two variables as contemplated above in Figure 4.1), the typical data distribution region would be three-dimensional – in an egg-like shape, or ovoid – rather than a two-dimensional oval.

52. This data driven approach is also not fixed; it is flexible to adapt as the underlying company data changes in future years. With each data update, though the method to determine the Mahalanobis distance values for each observation and the method for determining which observations are outliers will stay that same, the threshold (the boundary of the ovoid or shell of the egg) will naturally adapt to correspond with the calibrating data. This is a distinct flexibility and robustness advantage over any method which sets any fixed single or set of thresholds to determine observation outliers.

V. CAPITAL STRUCTURE

A. Capital Structure in the Staff's DuPont Model

53. The January 2019 Staff Proposal seeks to update the manner in which capital structure is handled compared with the LG model. The LG model, in essence, based on a regression model which predicts PM based on ATO of a company, finds a calculated ROE. This calculated ROE is invariant to the actual capital structure of the company of the solid waste collection company itself, though the PM changes based on the capital structure of the

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[33] Note that the addition of D/E to the regression model is discussed in detail below.

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company.[34] The January 2019 Staff Proposal's DuPont model instead estimates the PM of a firm (from a regression of PM on ATO). By doing so, the calculated ROE does change when the capital structure of a firm changes.[35]

54.   The Staff Proposal describes that the basis for this structure of the DuPont Model is the Modigliani and Miller Theorem. The Staff Proposal elaborates on this theorem:[36]

> The commonly-called Modigliani and Miller Theorem holds that the weighted average cost of capital does not change as capital structure changes. The pair showed the value of a company is in its operations, not in the method used to finance those operations. For example, Modigliani and Miller showed that as debt increased, equity shareholders perceive higher risk and expect a higher return, thereby increasing the cost of equity. But, because the equity component would make up a smaller portion of the total capital structure due to the higher debt load, the weighted cost of equity may actually decrease. Therefore, in spite of increased costs for both debt and equity, the overall average weighted cost of capital would remain close to the pre-leverage structure.
>
> In addition, the DuPont Formula Model assumes the proxy companies will, as a group, reflect the optimal cost of capital. The model assumes the specific capital structures financial the operations of the proxy companies are not relevant to the computation of revenue requirement because the average weighted cost of capital reflected in the data should be optimal and consistent with the Modigliani and Miller theorem. Simply put, the weighed cost of capital is not materially affected by capital structure.

55.   The January 2019 Staff Proposal relies entirely on the Modigliani-Miller Theorem for its treatment of (and decision to not adjust for) capital structure in the DuPont model.

B. Assumptions and Empirical Assessment of the Modigliani-Miller Theorem

56.   Economic theories are meant to be tested, both in terms of the underlying assumptions and with empirical testing. Jean Tirole, also a Nobel-prizing winning economist for his work in industrial organization, describes the Modigliani-Miller Theorem in his book The Theory of Corporate Finance:[37]

> As a matter of fact, economists were stunned when, in two articles in 1958 and 1961, Modigliani and Miller came up with the following rather striking and somewhat counterintuitive result. Under some conditions, the total

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[34] *See*, January 2019 Staff Proposal, p. 15, Chart 2.

[35] *See*, January 2019 Staff Proposal, p. 17, Chart 4.

[36] January 2019 Staff Proposal, p. 12.

[37] Tirole, Jean, The Theory of Corporate Finance, Princeton University Press, 2006, pp. 77-78.

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value of the firm – that is, the value of all claims over the firm's incomes – is independent of the financial structure. That is, the level of debt, the split of debt into claims with different levels of collateral and different seniorities in the case of bankruptcy, dividend distributions, and many other characteristics or policies relative to the financial structure have no impacts on total value. In other words, decisions concerning the financial structure affect only how the "corporate pie" (the statistical distribution of income that the firm generates) is shared, but has not effect on the total size of the pie. Thus, an increase in debt or a dividend distribution dilutes the debt-holders' claim and benefits the shareholders, but the latter's gain exactly offsets the former's loss.

57. However, Tirole also underscores the disconnect between the real world and what is predicted by the Modigliani-Miller Theorem, and the research by economists into the factors that may influence these disconnects:[38]

> It is only recently that economists have started developing a better understanding of the role of the financial structure. And, although the theory of corporate finance is still evolving, it is fair to say that considerable progress has been made. To examine whether the business community's close attention to the financial structure is warranted, economists have questioned the idea that the size of the pie is exogenously determined. At an abstract level, one can analyze the matter in the following terms. *Whenever managerial decisions cannot be perfectly specified contractually*, the incentives given to those who pick those decisions affect the firm's income (the size of the pie) and therefore *the split of the pie matters*.

58. Tirole spends the next 24 pages or so of his book discussing details of debt and equity financing, addressing issues such as tax considerations ("debt usually enjoys tax advantages relative to equity"[39]), clientele effects ("financial intermediaries…have for regulatory reasons higher demands for certain classes of claims"[40]), and the enforcement of financial contracts ("[b]ankruptcy laws can therefore have an impact on the financial structure of firms."[41]). Thus, there are numerous avenues of research which question the underling propositions of the Modigliani-Miller Theorem and its implications.

59. Merton H. Miller (the "Miller" in the Modigliani-Miller Theorem) has acknowledged the difficulty that has been encountered in empirically demonstrating the operation of the Modigliani-Miller Theorem. In an article addressing the theorem 30 years after its introduction, Dr. Miller described that:

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[38] Tirole, Jean, The Theory of Corporate Finance, Princeton University Press, 2006, pp. 78-79. (emphasis added)

[39] Tirole, Jean, The Theory of Corporate Finance, Princeton University Press, 2006, p. 79.

[40] Tirole, Jean, The Theory of Corporate Finance, Princeton University Press, 2006, p. 79.

[41] Tirole, Jean, The Theory of Corporate Finance, Princeton University Press, 2006, pp. 80.

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Our Proposition I, holding the value of a firm to be independent of its capital structure (that is, its debt/equity ratio) is accepted as an implication of equilibrium in perfect capital markets. The validity of our then-novel arbitrage proof of that proposition is also no longer disputed, and essentially similar arbitrage proofs are not common throughout finance…[42]

…[I]t may be worth emphasizing at this point…that our proposition that value was independent of capital structure at the individual firm level was never intended to suggest that the debt/equity ratio was *indeterminate*. At the firm level, there were clearly other costs of the various financial alternatives to be taken into account…[43]

Indeed, we devoted more than a third of the original paper…to empirical estimates of how closely real world markets values approached those predicted by our model. Our hopes of settling the empirical issues by that route, however, have largely been disappointed. Direct statistical calibration of the goodness of fit of the MM value-invariance propositions has not so far been achieved by us or others for a variety of reasons…[44]

60. Levati et al (2012) provide an overview of the sorts of empirical studies described by Miller (and more) that do not find support for the Modigliani-Miller Theorem:[45]

The opposition to the MM theorem comes from many angles. Weston (1963) tests the theorem using the same sample of electricity utility industries as used by Modigliani and Miller (1958), but for the year 1959 rather than for the years 1947 and 1948. His multiple regression analysis indicates that leverage does have an influence on a firm's cost of capital when earnings growth is taken into account. Robichek et al. (1967) extend the analysis of Miller and Modigliani (1966) to the years 1955 and 1958–1964. They conclude that MM's results are a consequence of circumstances prevailing at the time of their study. Davenport (1971) uses data on three industry groups (chemicals, food, and metal manufacturing), and his results are indicative of a U-shaped cost of capital with respect to leverage. Other empirical studies suggesting that a firm's value changes significantly in response to changes in the capital structure include Masulis (1980), Dann (1981), Masulis and Korwar (1986), Pinegar and Lease (1986), Graham and Harvey (2001), and Arzac and Glosten (2005). These studies and, generally,

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[42] Miller, Merton H. (1988), "The Modigliani-Miller Propositions After Thirty Years," Journal of Economic Perspectives, 2(4): 99-120, at p. 99.

[43] Miller, Merton H. (1988), "The Modigliani-Miller Propositions After Thirty Years," Journal of Economic Perspectives, 2(4): 99-120, at p. 102. (emphasis in original)

[44] Miller, Merton H. (1988), "The Modigliani-Miller Propositions After Thirty Years," Journal of Economic Perspectives, 2(4): 99-120, at p. 103.

[45] Levati et al (2012), "Testing the Modigliani-Miller theorem directly in the lab," Experimental Economics, 15(4), pp. 693-716, p. 694.

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most of the works rejecting the propositions of the MM theorem rely on some kind of market imperfections.

61. The difficulties in demonstrating that the theory operates in the real-world stem from the rather strict assumptions adopted in the theory – in particular, the assumption of perfect capital markets and the ability to arbitrage (that is, the absence of market imperfections described by Levati et al (2012) above). Charness and Neugegauer (2019) describe the restrictiveness of these assumptions in the Modigliani-Miller Theorem:[46]

> The core of the theorem is an arbitrage proof, whereby if two assets, one leveraged and one unleveraged, represent claims on the same cash flow, any market discrepancies that arise are arbitraged away. But due to its assumptions of perfect capital markets and the no-limits-to-arbitrage condition (which requires the perfect positive correlation of asset returns, no fees on the use of leverage, etc.), the MM theorem has not been satisfactorily tested on real-world market data. Its empirical significance has thus been unclear.
>
> [fn1] The assumption of perfect capital markets requires, among other things, that no taxes and transaction fees be levied and that the same interest rate applies to everyone. Lamont and Thaler (2003) present several real-world examples where the law of one price is violated. They argue that these violations result from limits to arbitrage. An early objection concerned the applicability of value-invariance in relation to the variation of payout policy. Modigliani and Miller (1959) replied to this objection by stating that a firm's dividend policy is irrelevant for the value of the company. However, it is now widely accepted that dividends impact empirical valuations (for a recent discussion of the dividend puzzle, see DeAngelo and DeAngelo (2006)). With the dividend irrelevance theorem thus empirically rejected, it is considered as of theoretical interest only. The value-invariance theorem and its proof, however, have remained widely accepted in the profession even without empirical evidence to support it.

62. In sum, the Modigliani-Miller Theorem has not performed well under empirical testing over the last 60 years. So, while certain elements of the theorem have theoretical appeal, the real-world operates quite differently than what is assumed in the proposed DuPont model. In our view, the empirical shortcomings of the Modigliani-Miller Theorem mean that the assumptions underlying the proposed DuPont model also include those shortcomings. As such, we assume that the Modigliani-Miller Theorem strictly applied is not a best-practices approach for determining rates here. We present an alternative below

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[46] Charness, Gary and Tibor Neubegauer (2019), "A Test of the Modigliani-Miller Invariance Theorem and Arbitrage in Experimental Asset Markets," The Journal of Finance, 74(1): 493-529, at pp. 493-494. Charness and Neubegauer (2019) experiment provides some support for the Modigliani-Miller Theorem in a laboratory setting, based on study of the behavior of 174 students at the University of California, Santa Barbara, where arbitrage opportunities were permitted.

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that allows for the theoretical proposition described in the Modigliani-Miller Theorem, but also allows for real-world divergences from the strict assumptions of the theory.

C. Alternative Proposal for Capital Structure in the DuPont Model

63. As described above, given the lack of empirical evidence for the strict application of the Modigliani-Miller Theorem in the real world, the inclusion of this theorem in the rate-setting process here would be to rest on a proposition without widespread empirical support.

64. There is a better alternative. Instead, we propose that capital structure of transportation firms be included in the regression model itself. This approach allows for the experiences of the transportation industry itself to dictate to what extent the Modigliani-Miller Theorem applies in the real world. We submit that this approach is superior to imposing a relationship between capital structure and returns that does not exist in reality.

65. Another advantage of this approach is that it brings the proposal closer to the original concept of the DuPont formula approach. The DuPont formula essentially has 3 elements: profit margin (PM), asset turnover (ATO), and the capital structure (D/E). The January 2019 Staff Proposal analyzes two of these (profit margin and asset turnover), but ignores the third (capital structure). Incorporating capital structure into the regression model itself once again would capture all elements of the DuPont formula, but in an empirical manner (as opposed to any rigid tautological relationship).

66. Table 5.1 below shows empirical results from potential ways of modeling capital structure (D/E) using the firms for Models 1 and 2. Specification (1) shows regression results for Model 1 without any allowance for capital structure, but with the natural log of ATO. Specification (2) shows results when the natural log of D/E is included for Model 1. Specification (3) shows the regression results for Model 2 without any allowance for capital structure. Specification (4) shows the regression results when the natural log of D/E is included for Model 2.

TABLE 5.1

TABLE 5.1
Regression Specifications Incorporating Debt/Equity[47]

	Model 1		Model 2	
Specification:	1	2	3	4
(Intercept)	3.723***	4.149***	4.858***	5.385***
	[0.124]	[0.203]	[0.082]	[0.135]
Ln(ATO)	-0.302***	-0.303***	-0.503***	-0.482***
	[0.023]	[0.023]	[0.018]	[0.018]
Ln(Debt/Equity Ratio)		-0.077**		-0.121***
		[0.033]		[0.023]
N	801	741	1,241	1,184
R2	0.174	0.196	0.382	0.395
Adjusted R2	0.173	0.193	0.381	0.394
AIC	1,999.649	1,776.430	2,847.708	2,580.379

Standard errors are reported in brackets. *, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.

67. Table 5.1 demonstrates that capital structure is empirically related to the PM for firms in the transportation industry in a non-linear manner. That is, each of the non-linear coefficients for D/E are statistically significant. In our view, the second and fourth specifications in Table 5.1 are most appropriate for use in estimating profit margins here.

68. Figures 5.2 and 5.3, below, show the PM and calculated ROE for a hypothetical firm (with ATO of 142.86) with varying levels of debt. As these figures demonstrate, the empirical relationship we estimate is consistent with the Modigliani-Miller Theorem directionally, in that as D/E increases, the ROE also increases – though not to the full extent predicted by the Modigliani-Miller Theorem. We view our proposal as both allowing for the theoretical proposition of the Modigliani-Miller Theorem, while also recognizing the empirical realities regarding capital structure and value.[48]

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[47] R-squared measures the proportion of the total sample variation in the dependent variable that is explained by the independent variable(s). The adjusted r-squared adjusts the r-squared by taking into account the number of independent variables used in the model. The Akaike Information Criterion (AIC) is an estimator of statistical model quality where a lower AIC value is generally considered to demonstrate better "fit" for a model.

[48] The non-linear relationship between D/E and PM is captured through use of natural log (for both variables). Given this non-linear relationship, as the D/E gets closer to a value of 0, the predicted PMs increase proportionately with a proportionate reduction in D/E. Therefore, we have incorporated an adjustment such that the D/E is not permitted to fall below a value of 9, which would indicate 10 percent debt.

FIGURE 5.2
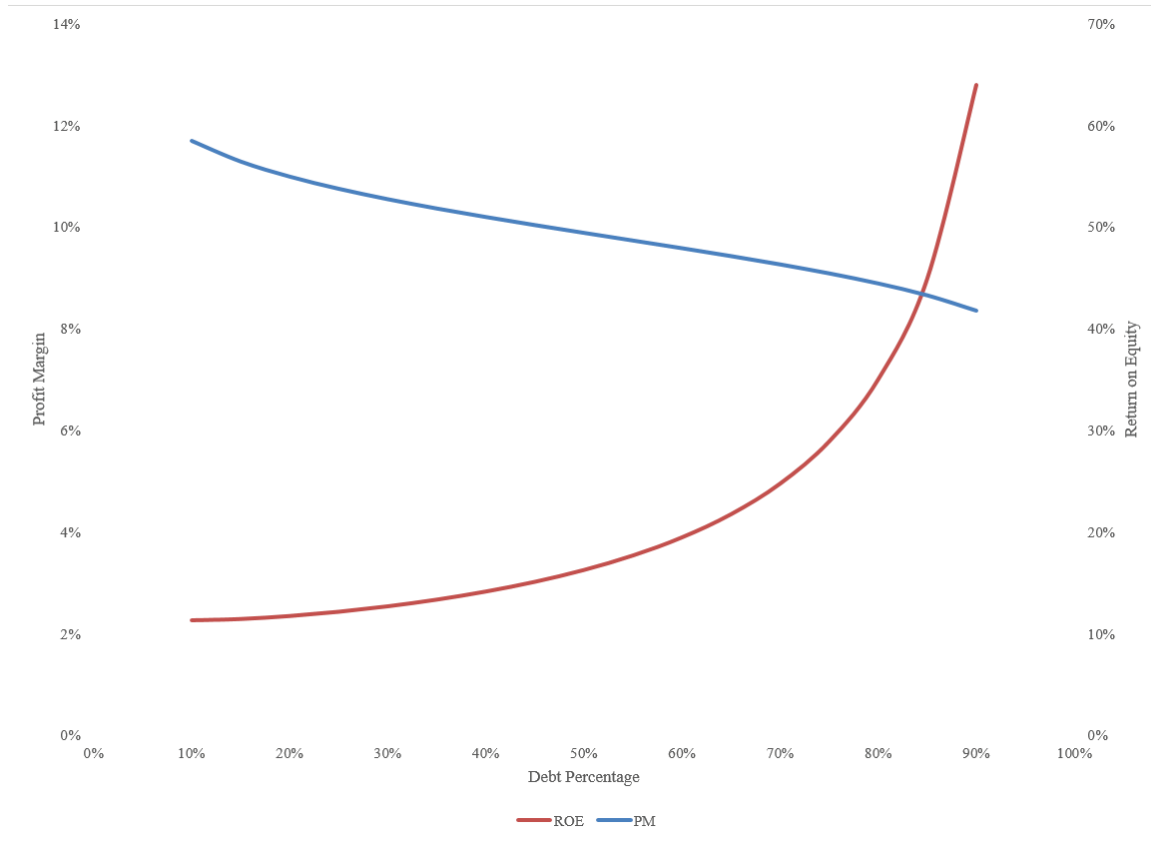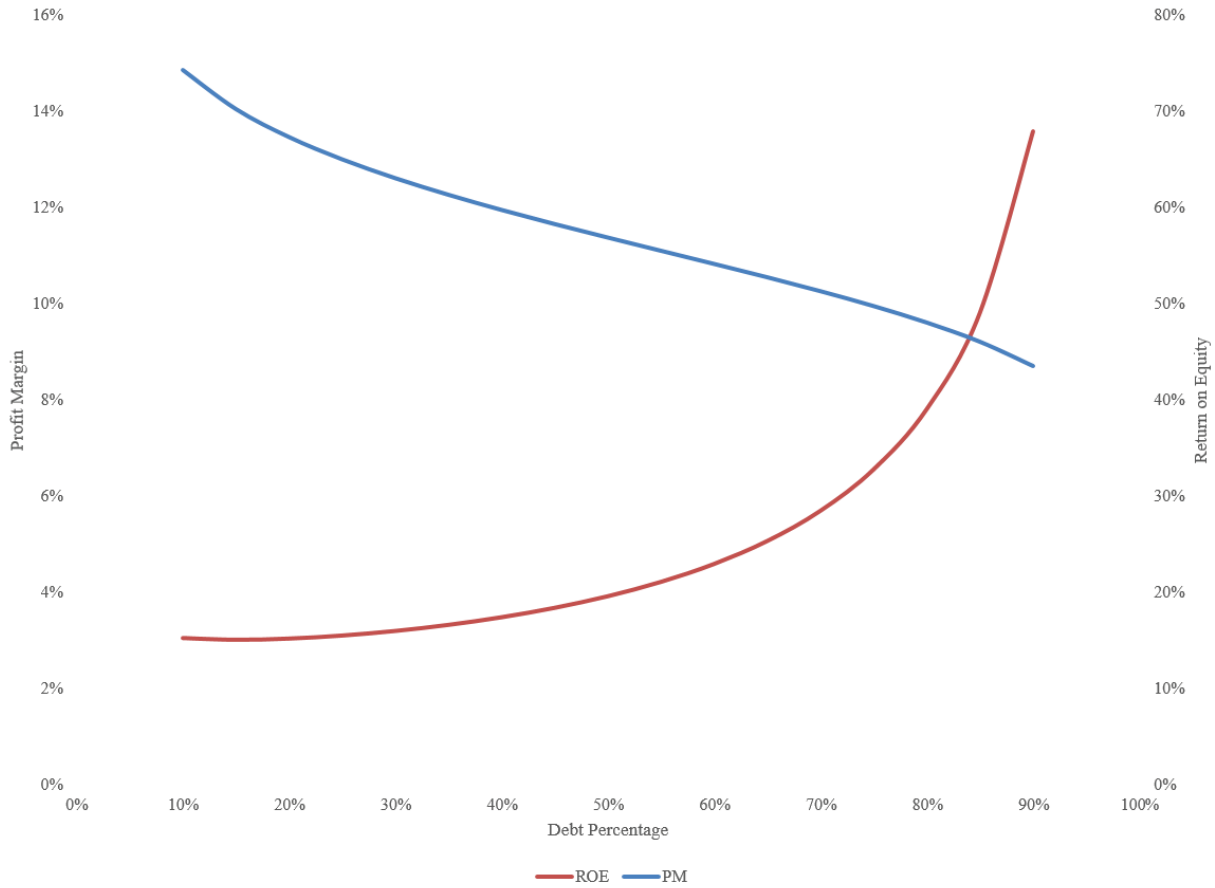**Profit Margin and ROE Predicted for Different Debt Percentages, Model 1**

FIGURE 5.3
Profit Margin and ROE Predicted for Different Debt Percentages, Model 2

VI.   REGRESSION ANALYSIS

A. Regression Model Specification

69.   Based on our discussions above, we propose using the following regression model for estimating PM for given values of ATO and D/E for a solid waste collection company:[49]

$$\ln PM = \alpha + \beta_1 (\ln ATO) + \beta_2 \left(ln \frac{D}{E} \right) + \varepsilon ,$$

where, *PM* is profit margin defined as *100*EBIT/(Net Revenue)*, *ATO* is defined as *100*(Net Revenue)/(Average PPE)*, and *D/E* is defined at *100*(Total Debt)/(Total Equity)*.[50]   This model is to be used in conjunction with the datasets described in Section

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[49] Note that this regression estimates statistical correlations and is not intended to represent a causal model.

[50] Each of these variables is multiplied by 100 prior to running the regression. This is consistent with the proposed Staff DuPont Model and the original LG regression.

III.A., above. The coefficient β_1 indicates the empirical relationship between ln(PM) and ln(ATO), all else equal. The coefficient β_2 indicates the empirical relationship between ln(D/E) and ln(ATO), all else equal.

70. The January 2019 Staff Proposal estimates its regression model using log10 as opposed to natural log (ln).[51] We recommend using natural log (ln), as this transformation of data is far more typical than the use of log 10. Given that we are seeking to build a model that will be used for years (and perhaps decades) into the future, using a recognized, standard approach for data transformation is more likely in our view to be accepted on a go-forward basis than using a non-conventional approach.

71. We propose using ten years of data for Model 1 and seven years of data for Model 2. The January 2019 Staff Proposal describes a trade-off between rapid updates to the model to reflect current economic conditions (especially with regard to inflation) and instability in results. Since we are proposing two models – Model 1 which is more precise with regard to the types of companies included, and Model 2 which is broader – this highlights another trade-off to consider. Using a longer time period provides more data for estimation of the regression. Since Model 1 is more selective in terms of the companies it includes, it also includes fewer companies, and thus, fewer observations to use in estimating empirical relationships through the regression analysis. Therefore, we propose a longer timeframe for Model 1 (10 years) compared with Model 2 (7 years). The evaluation of different timeframes is presented in our sensitivity analyses below.

B. Results

72. The results for Model 1 are shown above in Table 5.1 (specification 2); the results for Model 2 are shown above in Table 5.1 (specification 4). Figure 6, below, graphically shows PM for various ATO from 100 to 400 for both models.[52] As a reminder, Model 1 uses the more targeted set of SIC codes for companies that transport with the use of vehicles. Model 1 shows declining PM with greater ATO, though has a "flatter" relationship and is generally lower (for ATOs less than about 300) than Model 2.

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[51] In our testing, we have found similar results when using either natural log (ln) or log 10. The January 2019 Staff Proposal indicates that it also found the results similar between the two models.

[52] Assumes debt percentage of 55% and weighted cost of debt of 3.85%.

FIGURE 6
Predicted PM for Model 1, Staff Proposed Model, and LG
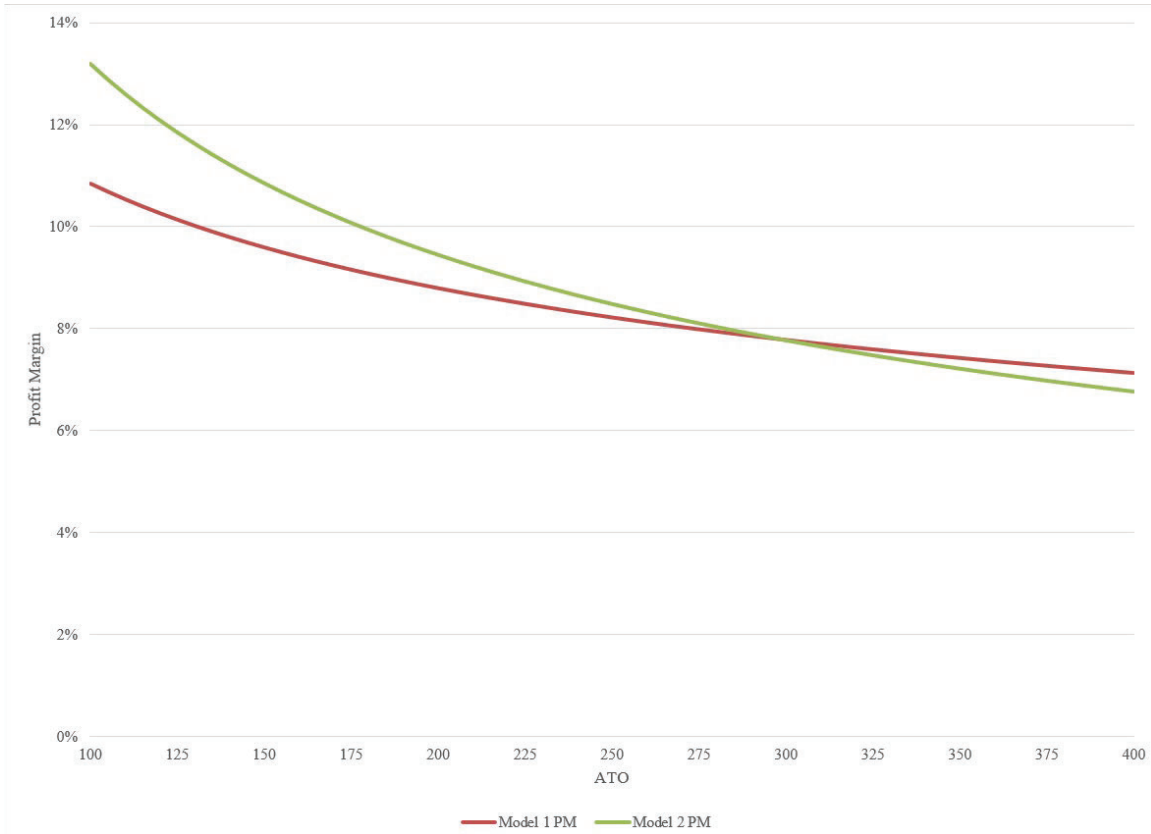
C. Sensitivity Testing

1. Timeframe Used in Regression Analyses (5, 7, or 10 years)

73.   As described above, we propose the use of 10 years of data for Model 1 and the use of 7 years of data for Model 2. These proposed timeframes are based the tradeoffs between incorporated information captured recent macroeconomic conditions and having sufficient data for a reliable estimate of the relationships between ATO, D/E, and PM.

74.   Here, we use Compustat data (since it is available going back many decades) to evaluate the use of 5, 7, or 10 years. We do this by running Model 1 and Model 2 repeatedly through time beginning in year 1968 all the way through 2018. For example, for Model 1 (including selecting companies in the SIC codes back in 1968) we run Model 1 for the period 1968-1977, but also for every 10-year period to the present (*i.e.*, 1969-1978, 1970-1979, …, 2009-2018). This approach gives us many time-periods over which we can calculate predicted margins (PM) for each model (*e.g.* 42 for the 10-year timeframe).

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75.   Figure 6.3 shows the predicted PMs for both Model 1 and Model 2 assuming an ATO of 300 and a D/E of 100.[53] The top row of charts shows the frequency distribution of PM for Model 1, using 5 years of data, 7 years of data, and 10 years of data (reading left to right). The lower row of charts shows the frequency distribution of PM for Model 2. The blue dotted lines show the results for Model 1 from the most recent time-frames available (and thus is comparable to our proposal for Model 1). The orange dotted lines show the results for Model 2 from the most recent time-frames available (and thus is comparable to our proposal for Model 2).

FIGURE 6.3
Frequency Distribution of PM for Model 1 and Model 2

Predicted PMs at ATO=300 & D/E=100
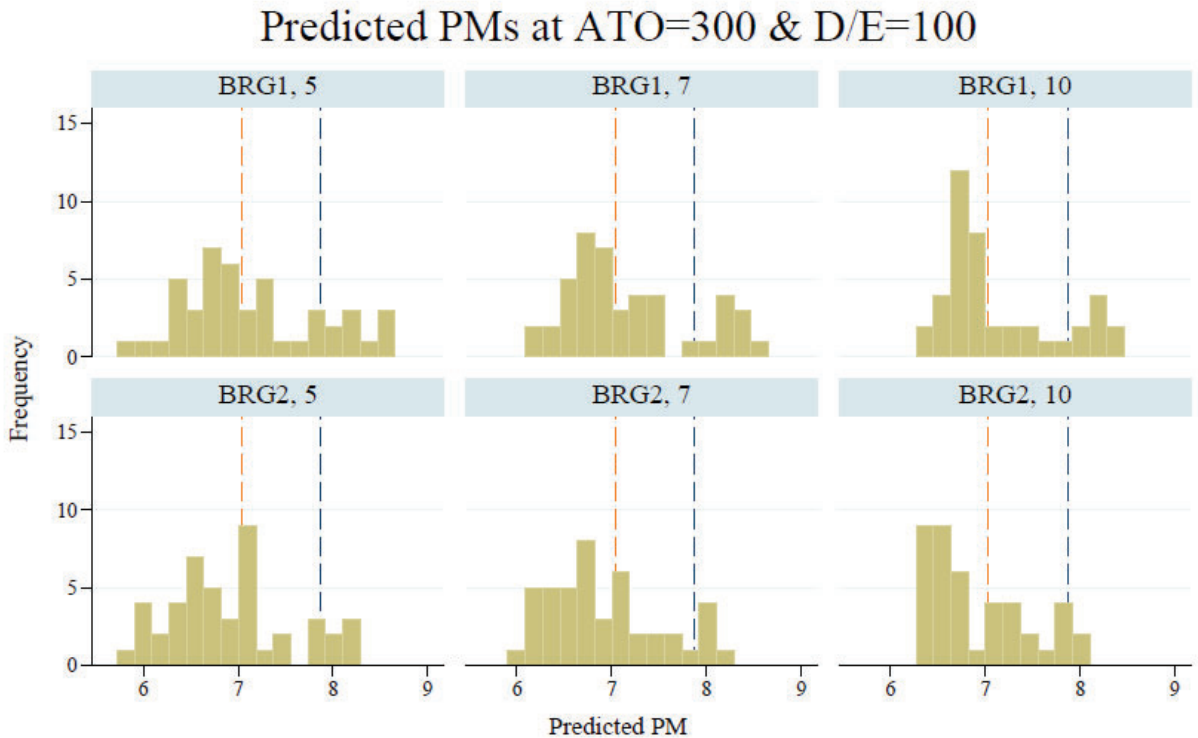
Notes:
[1] PMs predicted for models ranging from 1968 through 2018.
[2] Navy dashed vertical bar represents predicted PM using the BRG Model #1 over 2009-2018 at ATO=300 & D/E=100.
[3] Orange dashed vertical bar represents predicted PM using the BRG Model #2 over 2012-2018 at ATO=300 & D/E=100.

Source: Compustat financial data.

76.   Figure 6.3 shows that the frequency distribution getting "tighter" (*i.e.*, less spread out) if longer time-frames are used. This makes sense in that as we add more data, we would expect to see less variation in the predictions. We also see that Model 2 is somewhat "tighter" (*i.e.*, less spread out) than Model 1 for the same number of years used. This again makes sense since we have more observations for Model 2. Finally, these numbers show that historically speaking we are towards the top of the distribution (especially for Model 1). However, we have observed that margins have increased for the transportation industry

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[53] Both the ATO and D/E are indexed (multiplied by 100) to stay consistent with the methods used in the original LG and the proposed Staff DuPont Model.

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in recent years (see, Table 2.4 for instance). So, we do not know if the higher margins predicted today represent a "high-water mark" with reversions to the mean to be expected, or represent a new normal of higher margins compared with what has been historically observed.

2. Outlier

77.   Observations are identified as outliers if their calculated Mahalanobis distance exceeds the 95th percentile for a chi-square distribution with three degrees of freedom (5% of the theoretical chi-square distribution exceeds this threshold). Tables 6.1 and 6.2 show that adjusting this threshold to the 90th or 99th percentile has little impact on the results for six company comparables.

TABLE 6.1
Outlier Threshold Sensitivity Testing in Model 1

Company	5% Chi-Squared Trimming			10% Chi-Squared Trimming			1% Chi-Squared Trimming		
	Revenue Increase	Operating Ratio	ROE	Revenue Increase	Operating Ratio	ROE	Revenue Increase	Operating Ratio	ROE
Waste Management	2,271,824	92%	26%	2,271,824	92%	26%	2,267,160	92%	26%
Peninsula Sanitation Services, Inc.	-5,317	91%	19%	-5,317	91%	19%	-4,803	91%	19%
Rabanco	305,447	92%	29%	305,447	92%	29%	306,140	92%	29%
Stanley's Sanitary Service	64,809	90%	14%	64,809	90%	14%	64,767	90%	14%
Yakima Waste Systems, Inc.	431,816	92%	30%	431,816	92%	30%	431,710	92%	30%
Methow Valley Sanitation Service	118,228	92%	20%	118,228	92%	20%	118,295	92%	20%

TABLE 6.2
Outlier Threshold Sensitivity Testing in Model 2

Company	5% Chi-Squared Trimming			10% Chi-Squared Trimming			1% Chi-Squared Trimming		
	Revenue Increase	Operating Ratio	ROE	Revenue Increase	Operating Ratio	ROE	Revenue Increase	Operating Ratio	ROE
Waste Management	2,470,045	91%	27%	2,470,045	91%	27%	2,470,045	91%	27%
Peninsula Sanitation Services, Inc.	18,995	90%	21%	18,995	90%	21%	18,995	90%	21%
Rabanco	308,418	92%	29%	308,418	92%	29%	308,418	92%	29%
Stanley's Sanitary Service	73,357	88%	17%	73,357	88%	17%	73,357	88%	17%
Yakima Waste Systems, Inc.	442,489	92%	30%	442,489	92%	30%	442,489	92%	30%
Methow Valley Sanitation Service	122,552	91%	22%	122,552	91%	22%	122,552	91%	22%

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VII. FINAL ISSUES AND CONCLUDING REMARKS

78. Several additional issues were raised in the January 2019 Staff Proposal that are addressed here.

Range of Return

79. First, the January 2019 Staff Proposal introduces a "Range of Return" whereby "[s]taff proposes in its model a range of +/- one standard deviation associated with the regression's y-intercept coefficient…"[54] This range is based on one robust standard error of the intercept in the regression model.[55]

80. A standard error is a measure of the precision of a regression model's estimate, here, for the intercept term. This error provides information about the range in which the true value of the estimated coefficient is likely to reside. For rate-setting purposes, we think there is insufficient justification to use estimates incorporating the variability of a single coefficient from the regression model rather than the "best estimate" provided by the regression. This is, after all, the best estimate. We see insufficient justification for suggesting a range of results rather than use of the best estimate.

81. If the WUTC seeks a range of return, we recommend changing other inputs that feed into to Staff Proposed Spreadsheet such as the allowable expenses, or investments. Our understanding is that differences in allowed rates are likely to be related to these inputs in the rate-setting process.

Frequency of Updates
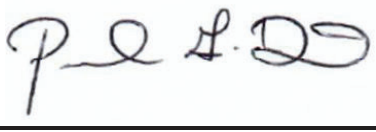
82. The regression analysis that we conduct is based on annual data. From a modeling perspective, the regression analysis could be updated as frequently as each year. However, we recognize that every regression update can impose costs on both the regulators and the regulated. In our view, these regulation update costs are the appropriate driver of this decision. There are benefits from rapid updates, but also believe most of those benefits would be achieved even with updates that occur every 5 years.

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[54] January 2019 Staff Proposal, p. 17.

[55] January 2019 Staff Proposal, p. 17, footnote 35.

X _Cleve B. Tyler_

Cleve B. Tyler

X _Paul Diver_

Paul Diver

35

EXHIBIT CT – R5
AG00049 – AG00052, OPERATING RATIO QUESTION

From:	Fairchild-Hamilton, Janet K (LAW)
To:	Kermode, Danny (UTC)
Subject:	Re: Operating Ratio Question
Date:	Wednesday, July 22, 2020 7:23:54 AM

I'm wide open next week. How about Monday?

From: Kermode, Danny (UTC) <danny.kermode@utc.wa.gov>
Sent: Tuesday, July 21, 2020 9:48 AM
To: Fairchild-Hamilton, Janet K (LAW) <janet.fairchild-hamilton@alaska.gov>
Subject: FW: Operating Ratio Question
Hi Janet,
I'm back from my Stay-cation! Recharged a bit... and I had a chance to read the testimony that you sent, great stuff... it does a good job of arguing the state of the issue.
I'm wondering if you want to look at locking in a time next week?
Good luck on your case! Take care and stay safe!
-Danny
Danny Kermode CPA
Assistant Director for Water and Transportation
Washington Utilities & Transportation Commission
ph: 360.664.1253 I danny.kermode@utc.wa.gov

From: Fairchild-Hamilton, Janet K (LAW) <janet.fairchild-hamilton@alaska.gov>
Sent: Wednesday, July 8, 2020 11:53 AM
To: Kermode, Danny (UTC) <danny.kermode@utc.wa.gov>
Subject: Re: Operating Ratio Question
Can we set up a time the week of the 27th to talk about potential questions I might get on my recommendation? I have a hearing in another matter the 20th - 22nd but should be able to prepare to discuss the AK OR with you more intelligently the latter part of that week.
Here is our witness testimony from the last case. OR testimony begins at page 32.
http://rca.alaska.gov/RCAWeb/ViewFile.aspx?id=E96089A8-0E01-4E0D-A617-58D8B7621BBD
Here is Alaska Waste's reply testimony.
http://rca.alaska.gov/RCAWeb/ViewFile.aspx?id=24968623-dbe4-4cfd-9f77-3d2437b0f9a9
The case settled.

From: Kermode, Danny (UTC) <danny.kermode@utc.wa.gov>
Sent: Wednesday, July 8, 2020 10:17 AM
To: Fairchild-Hamilton, Janet K (LAW) <janet.fairchild-hamilton@alaska.gov>
Subject: RE: Operating Ratio Question
I'm glad I'm able to help and I'm especially glad that my chairman let me be involved.
What can I do to help at this point? I can work with your witness to help with reply if that would be helpful.
As for the settled OR, as I'm sure you know, their has always been a problem with the "traditional" methods of setting OR since there is no relationship to total investment. These approaches solve the problem... Have you read the DC decision addressing the problem? (350 F.2d 753; 63 P.U.R.3d)
Just to let you know if I haven't told you before, I'm off all next week and will be back the following

AG00049

Monday.

-Danny

Danny Kermode CPA

Assistant Director for Water and Transportation

Washington Utilities & Transportation Commission

ph: 360.664.1253 | danny.kermode@utc.wa.gov

From: Fairchild-Hamilton, Janet K (LAW) <janet.fairchild-hamilton@alaska.gov>

Sent: Tuesday, July 7, 2020 5:30 PM

To: Kermode, Danny (UTC) <danny.kermode@utc.wa.gov>

Subject: Re: Operating Ratio Question

Thank you so much Danny!

This case is ballooning with new issues under every rock. Your help with this is really saving my bacon.

In answer to your questions, the current ORs for all the Alaska refuse utilities were set by stipulations from the late 80s and early 90s. In the last round of cases we had an economist look the models but in the end we ended up stipulating to what they had in the past.

From: Kermode, Danny (UTC) <danny.kermode@utc.wa.gov>

Sent: Tuesday, July 7, 2020 3:44 PM

To: Fairchild-Hamilton, Janet K (LAW) <janet.fairchild-hamilton@alaska.gov>

Cc: Craig, Lew (LAW) <lew.craig@alaska.gov>

Subject: RE: Operating Ratio Question

Hi Janet,

I finally was able to focus some time on the models. You will note I have added the AK Income Taxes to both models.

See my answers to your other questions below **in red**.

- Danny

Danny Kermode CPA

Assistant Director for Water and Transportation

Washington Utilities & Transportation Commission

ph: 360.664.1253 | danny.kermode@utc.wa.gov

From: Fairchild-Hamilton, Janet K (LAW) <janet.fairchild-hamilton@alaska.gov>

Sent: Thursday, June 25, 2020 1:13 PM

To: Kermode, Danny (UTC) <danny.kermode@utc.wa.gov>

Cc: Craig, Lew (LAW) <lew.craig@alaska.gov>

Subject: Operating Ratio Question

Hi Danny,

I hope all is well with you. I am still primarily working on other parts of the Alaska Waste rate cases, but they have agreed that my calculations of the OR under the LG Model currently approved in Washington and under the DuPont Model are accurate.

I've attached those calculations and the following table summarizes the results.

	Anchorage	Mat-Su	Interior	Kenai	Denali	Nome	Juneau	Dutch Harbor	Ketch
CPCN	692	731	667	714	502	655	653	654	656

AG00050

OR Calculated from Revenue Requirements	0.907	0.914	0.916	0.903	0.905	0.934	0.915	0.914	0.911
OR Per Alaska Waste Models	0.976	0.914	0.916	0.903	0.905	0.934	0.915	0.914	0.911
OR Per Currently Approved Washington LG Model	0.924	0.940	0.945	0.907	0.915	0.970	0.941	0.941	0.934
OR Per DuPont Model	0.946	0.960	0.963	0.931	0.938	0.982	0.960	0.961	0.955

Can you take a look at the models and see if you see any areas for concern?

Also, does Washington include an income tax allowance in refuse utility revenue requirements? (In Alaska that has generally not been the case.)

This is a great question. The LG model does include an income tax component in its computation. However, the DuPont model does not, however I compute the income tax impact under both models to show actual ROR and ROE. The DuPont model doesn't explicitly recognize income tax because earnings are set using comparable earnings at the EBIT (earnings before interest and taxes). I argue that EBIT implicitly already contains the income tax and interest components, including it would lead to a double collection.

How can I best add Alaska's 9.4 percent State income tax into the models? (Alaska Waste's consultant did not incllude it in their models, but it seems like it should be considered.)

I did for you, I have attached the new models with the AK income tax rates embedded in the models. (1) The LG workbook has the original worksheet and the updated worksheet. The updated sheet is labeled with a .1 so for example Juneau .1 is the worksheet with income taxes. (2) DuPont is not effected by income taxes since its data is based on EBIT so I just updated the ROR/ROE to give its impact.

Under the DuPont model some of the ORs are as high as 0.98. In cases where the OR is high (for example over the 0.95 currently allowed for Anchorage) what additional analysis should be conducted.

The issue of the 98 operating ratio is caused by the large asset turnover ratio (revenue/assets) ... If you recognize that in the industry, an asset turnover ratio ranges from 300 low to a high of around 450 is expected, Nome, the company with the 98 operating ratio, is at an astounding 1,177! What you should find interesting is, although the operating ratio is only 98, it has a ROE of 25.97%! Taken further, it's the small investment that is driving the low operating ratio. I would look at how is WM investing in Nome, I have seen some companies with low operating ratios have wornout or fully depreciated equipment OR frankly... check if the asset listing correct.

Remember also, WM is using the regression results from their consultant's study of comparable earnings... when I looked at their comparable companies.. I would suggest...

they weren't... and, in my opinion, overstate the ROE. Also, as the LG is designed... it uses the same ROE with no recogniztion of the change in capital structure, therefore, companies that are equity rich get a greater return than I think is correct.

Finally, how do you compute your OR? They seem fairly generous..

Keep Safe and Well... -Danny

Thank you for your help!

Janet

907-355-0393

EXHIBIT CT – R6
EXCERPT FROM AW-AG-1

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STATE OF ALASKA

THE REGULATORY COMMISSION OF ALASKA

Before Commissioners: Robert M. Pickett, Chairman
                                                Stephen McAlpine
                                               Antony G. Scott
                                                 Daniel A. Sullivan
                                                 Janis W. Wilson

In the Matter of the Tariff Filing Designated as TA127-692 and TA132-692 Filed by WASTE CONNECTIONS OF ALASKA, INC.	))) U-20-002)
In the Matter of the Tariff Filing Designated as TA90-731 Filed by ALASKA WASTE MAT-SU, LLC d/b/a ALASKA WASTE	))) U-20-003))
In the Matter of the Tariff Filing Designated as TA115-667 Filed by ALASKA WASTE - INTERIOR, LLC d/b/a ALASKA WASTE	))) U-20-004))
In the Matter of the Tariff Filing Designated as TA92-714 Filed by ALASKA WASTE - KENAI PENINSULA, LLC d/b/a ALASKA WASTE	))) U-20-005))
In the Matter of the Tariff Filing Designated as TA49-502 Filed by ALASKA WASTE - DENALI, LLC	))) U-20-006))
In the Matter of the Tariff Filing Designated as TA52-653 Filed by ALASKA WASTE - JUNEAU, LLC	))) U-20-007))
In the Matter of the Tariff Filing Designated as TA44-654 Filed by ALASKA WASTE - DUTCH HARBOR, LLC	))) U-20-008))
In the Matter of the Tariff Filing Designated as TA42-655 Filed by ALASKA WASTE - NOME, LLC	))) U-20-009))

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OFFICE OF THE ATTORNEY GENERAL'S RESPONSE TO ALASKA WASTE'S FIRST DISCOVERY REQUESTS TO THE ATTORNEY GENERAL (AWC-AG-1)

I. General Objections

1. The Office of the Attorney General, Regulatory Affairs & Public Advocacy Section (RAPA) objects to any Discovery Requests submitted by Waste Connections of Alaska, Inc., Alaska Waste Mat-Su, LLC d/b/a Alaska Waste, Alaska Waste Interior, LLC d/b/a Alaska Waste, Alaska Waste – Kenai Peninsula, LLC d/b/a Alaska Waste, Alaska Waste - Denali, LLC, Alaska Waste - Juneau, LLC, Alaska Waste - Dutch Harbor, LLC, and Alaska Waste – Nome, LLC; (collectively referred to as "AWC"), that seeks information protected by the Attorney-Client, Attorney Work Product or any other applicable privilege.

2. RAPA objects to any and all instructions contained in AWC's Discovery Requests to the extent the instructions exceed the discovery requirements and obligations governed by statute, regulation and Commission precedent.

By submitting responses and objections to these Discovery Requests, RAPA does not waive any Attorney – Client or Attorney Work Product privilege that may also be applicable.

Each and every discovery response by RAPA is made subject to the above-stated general objections.

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the models, explained the model inputs, showed Ms. Fairchild-Hamilton how to

incorporate the Alaska tax structure into the DuPont model, and answered questions

regarding the WTUC staff's January 16, 2019 recommendations to the Washington

Commission. Note that Ms. Fairchild-Hamilton independently incorporated the Alaska

tax structure in the DuPont Model following WUTC staff's example.

Answering Witness: Janet Fairchild-Hamilton.

Designated Hearing Witness: Janet Fairchild-Hamilton.

AW-AG-1-21.   Did Ms. Fairchild-Hamilton re-run any regression analyses

to evaluate or check the results of the BRG Model or the DuPont Model? If so, please

provide her work papers with all formulae intact.

Response: No. Ms. Fairchild-Hamilton re-ran the LG Model and the DuPont

Model and compared the results to Dr. Tyler's BRG Model, but did not rerun the

underlying regressions included in any of the three models. See workpapers Bates

Numbered AG00026-AG00035 (DuPont Model Results Ak Waste RR) and AG00036-

AG00045 (LG Model Results Ak Waste RR) provided in response to AW-AG-1-1.

Ms. Fairchild-Hamilton did not develop or create any model. Instead, she used these

two known modifications to the LG model- which is approved by the WUTC for

calculating an OR for refuse hauling - to generate results using Alaska Waste's

proposed revenue requirements. She then compared those results to results from the out-

dated LG model to determine which of the newer models produced a reasonable result.

Ms. Fairchild-Hamilton's goal was to determine which model produced the most

reasonable results and then use that model for recommending an appropriate OR for the

Alaska Waste utilities.

Answering Witness: Janet Fairchild-Hamilton.

Designated Hearing Witness: Janet Fairchild-Hamilton.

AW-AG-1-22. Please refer to the Prefiled Testimony of Janet K. Fairchild-

Hamilton at Q/A 51.

(a) Please explain what you did specifically to compare and/or evaluate the

reasonableness of:

(i) the DuPont Model and BRG Model datasets; and

(ii) the DuPont Model and BRG Model regression methods.

Response: (a) (i) & (ii) See response to Ms. Fairchild-Hamilton's

testimony at Q/A 52. Ms. Fairchild-Hamilton did not perform a detailed evaluation of

the DuPont or BRG Models. That was not the purpose of her testimony. She did review

the companies included within each dataset (proxy group) to determine whether they

met the proxy criteria noted by Dr. Tyler and the WUTC staff. She expressed concern

that some of the companies within Mr. Tyler's dataset did not appear to be reasonable

proxies for the Alaska Waste utilities.

Ms. Fairchild-Hamilton used the two known modifications to the LG model –

which is approved by the WUTC for calculating an OR for refuse hauling - to generate

results using Alaska Waste's proposed revenue requirements. She then compared those

results to results from the out-dated LG model to determine which of the newer models

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produced a reasonable result. Ms. Fairchild-Hamilton's goal was to determine which

model produced the most reasonable results and then use that model for recommending

an appropriate OR for the Alaska Waste utilities.

> **Answering Witness**:   Janet Fairchild-Hamilton.

> **Designated Hearing Witness**:   Janet Fairchild-Hamilton.

> **AW-AG-1-23.**   Please refer to the Prefiled Testimony of Janet K. Fairchild-

Hamilton at Q/A 51.

> (a)   What specific analytical work did you perform to assess the

reasonableness of the DuPont Model?

> (b)   Please provide any and all related work product.

> **Response**:   (a)   OBJECTION to the extent the phrase "analytical work" is

ambiguous and subject to multiple interpretations and to the extent the information

sought is already contained in the testimony of Ms. Fairchild-Hamilton. Subject to these

and the general objections, RAPA responds as follows: Ms. Fairchild-Hamilton's

analysis is described in Q/A 50-59.

> Ms. Fairchild-Hamilton used these two known modifications to the LG model –

which is approved by the WUTC for calculating an OR for refuse hauling - to generate

results from using Alaska Waste's proposed revenue requirements. She then compared

those results to results from the out-dated LG model to determine which of the newer

models produced a reasonable result. Ms. Fairchild-Hamilton's goal was to determine

which model produced the most reasonable results and then use that model for

recommending an appropriate OR for the Alaska Waste utilities.

(b) Workpapers were provided in response to AW-AG-1-1, Bates numbered

AG00015-AG00045. (DuPont Model Results Ak Waste RR), (LG Model Results Ak

Waste RR) and (RAPA proposed OR).

Answering Witness: Janet Fairchild-Hamilton.

Designated Hearing Witness: Janet Fairchild-Hamilton.

AW-AG-1-24.   Please refer to the Prefiled Testimony of Janet K. Fairchild-

Hamilton at Q/A 58. Ms. Fairchild-Hamilton states that the LG Model represents "a

logical starting point because it is the only model that has been explicitly approved by a

regulatory body." Do you agree that if the WUTC replaces the LG Model with another

model ("Updated Model"), this "Updated Model" would be the logical starting point for

determining the appropriate return allowance in these proceedings? If you do not agree,

please explain what you believe would be the logical starting point in this circumstance.

Response: If the WTUC approves a significant change to the LG Model, then

there would be two methods that would have been approved for setting OR for refuse

utilities. In Ms. Fairchild-Hamilton's view, the LG Model and any modifications the

WUTC makes to its approved method of determining the appropriate return for refuse

utilities should be evaluated and considered by the RCA in setting rates for Alaska

refuse utilities. This does not mean that the RCA should be precluded from setting

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provided to the WUTC. RAPA also objects to the extent this request seeks an analysis not previously performed and outside the scope of Ms. Fairchild-Hamilton's testimony. Subject to these and the general objections, RAPA responds as follows:

With the possible exception of motor freight and other refuse haulers, all the companies included in the data samples of both Dr. Tyler and the WUTC staff are more capital intensive than the Alaska Waste refuse hauling companies. Ms. Fairchild-Hamilton did not generate a data sample. It appears that both Dr. Tyler and WUTC staff included industries in their data samples that are more capital intensive than refuse haulers in order to generate statistically valid samples. Ms. Fairchild-Hamilton agrees with Dr. Tyler and WUTC staff that this approach is necessary in this instance.

Answering Witness: Janet Fairchild-Hamilton.

Designated Hearing Witness: Janet Fairchild-Hamilton.

AW-AG-1-28.   Please refer to the Prefiled Testimony of Janet K. Fairchild-Hamilton at Q/A 52. Ms. Fairchild-Hamilton states that "[i]n reviewing of [sic] the two samples I found no anomalies in the DuPont sample."

(a)   What approach was taken by Ms. Fairchild-Hamilton to affirm that there were no anomalies in the DuPont sample?

(b)   What approach was taken by Ms. Fairchild-Hamilton to identify the anomalies in Dr. Tyler's BRG sample?

(c)   Please provide the underlying research used in Ms. Fairchild-Hamilton's evaluations.

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(d)   What is Ms. Fairchild-Hamilton's definition of a company that would be considered an anomaly for either sample?

Response: (a) & (b)   Ms. Fairchild-Hamilton performed a Google search of each company in each data set to determine if each company could reasonably considered a proxy for the Alaska Waste companies given the selection criteria provided by Dr. Tyler and the WUTC staff.

Note that Ms. Fairchild-Hamilton did not generate any data sets. Her evaluation of the data sets used by the DuPont Model and the BRG Model was limited to an evaluation of whether the companies in each data set appeared to be reasonable proxies for the Alaska Waste utilities. In her analysis, she used the two known modifications to the LG model – which is approved by the WUTC for calculating an OR for refuse hauling - to generate results from using Alaska Waste's proposed revenue requirements. She then compared those results to results from the out-dated LG model to determine which of the newer models produced a reasonable result. Ms. Fairchild-Hamilton's goal was to determine which model produced the most reasonable results and then use that model for recommending an appropriate OR for the Alaska Waste utilities.

(c)   Ms. Fairchild-Hamilton did not retain any notes or other documentation.

(d)   See Q/A 52 of Ms. Fairchild-Hamilton's testimony.

Answering Witness: Janet Fairchild-Hamilton.

Designated Hearing Witness: Janet Fairchild-Hamilton.

makes this on-going objection to each discovery request in the section. Subject to these

and the general objections, RAPA responds to the following discovery requests.

AW-AG-1-30. Please refer to the Prefiled Testimony of Janet K. Fairchild-

Hamilton at Q/A 53. Ms. Fairchild-Hamilton states that for the DuPont Model,

"companies with incomplete or obviously erroneous data were removed from the proxy

group during WUTC staff's initial review."

(a)   Is Ms. Fairchild-Hamilton aware of the criteria WUTC staff used to

determine what companies had incomplete or obviously erroneous data? If so, what are

the criteria?

(b)   What criteria does she propose should be used to determine what

companies had incomplete or obviously erroneous data?

Response: (a)   No. Ms. Fairchild-Hamilton did not have access to

information regarding what specific companies were excluded from either the BRG or

the DuPont models. Ms. Fairchild-Hamilton's evaluation of the data sets used by the

DuPont Model and the BRG Model was limited to whether the companies in each data

set appeared to be reasonable proxies for the Alaska Waste utilities. In her analysis, she

used the two known modifications to the LG model – which is approved by the WUTC

for calculating an OR for refuse hauling - to generate results using Alaska Waste's

proposed revenue requirements. She then compared those results to results from the out-

dated LG model to determine which of the newer models produced a reasonable result.

Ms. Fairchild-Hamilton's goal was to determine which model produced the most

1   reasonable results and then use that model for recommending an appropriate OR for the

2   Alaska Waste utilities.

3   (b)   OBJECTION to the extent this request is outside the scope of the

4   testimony of Ms. Fairchild-Hamilton and requires an analysis of information not

5   previously performed. Subject to this objection and the general objections, RAPA

6   responds as follows: Ms. Fairchild-Hamilton does not make a proposal regarding what

7   should be used to determine whether company data is incomplete or obviously

8   erroneous. Ms. Fairchild-Hamilton provides the Commission with the only model

9   approved for setting OR for refuse utilities by any regulatory body along with two

10 proposals for updating the model. Other than reviewing the proxy companies used in the

11 regression analysis embedded in each model, she based her recommendation on which

12 model produced the most reasonable result giving the trend in approved return

13 allowances over the last few decades.

14   **Answering Witness:**   Janet Fairchild-Hamilton.

15   **Designated Hearing Witness:**   Janet Fairchild-Hamilton.

16   **AW-AG-1-31.**   Please refer to Exhibit JKF-7 at paragraphs 37-38. There,

17 Dr. Tyler describes that removing data during an "initial review" injects an element of

18 subjectivity into an objective process.

19   (a)   Does Ms. Fairchild-Hamilton agree with the points made in the referenced

20 paragraphs? If not, please explain why not.

1 companies with ATO ratios of over 400 or Profit Margins of over 100 percent.

2 Ms. Fairchild-Hamilton believes that companies with those characteristics are not

3 representative of regulated services such as those provided by the Alaska Waste

4 utilities.

5

6   **Answering Witness**:   Janet Fairchild-Hamilton.

7   **Designated Hearing Witness**:   Janet Fairchild-Hamilton.

8   **AW-AG-1-33.**   Please refer to Exhibit JKF-7 at paragraph 46, where Dr.

9 Tyler describes that the WUTC staff remove "extreme outliers" constituting "any

10 companies with an ATO of greater than 400 and/or a PM of greater than 100."

11

12   (a)   Does Ms. Fairchild-Hamilton describe in A53 or elsewhere this step for

13 removing "extreme outliers" in the determination of the DuPont dataset in her

14 testimony? If so, please identify the exact location in her testimony. If not, please

15 explain why this is not addressed.

16   (b)   How many companies or observations did the WUTC staff exclude when

17 conducting this step?

18

19   (c)   Did Ms. Fairchild-Hamilton examine the work papers that Dr. Tyler refers

20 to?

21   (d)   Did Ms. Fairchild-Hamilton conduct any investigation to determine

22 whether she agrees that the WUTC Staff-proposed method to remove extreme outliers is

23 appropriate? If Ms. Fairchild-Hamilton's answer is yes, please provide the work papers

24 of this investigation.

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(e)   Does Ms. Fairchild-Hamilton consider companies with ATO greater than

400 or PM greater than 100 to be an appropriate definition of "extreme outliers"?

Please explain the rationale behind her conclusion.

Response: (a)   OBJECTION. This request seeks information that is equally

available to Alaska Waste in the form of the testimony of Ms. Fairchild-Hamilton.

RAPA also objects to the request in that by requesting that Ms. Fairchild-Hamilton

explain why she did *not* address a specific topic in her testimony the request seeks

information outside the scope of her testimony and is unlikely to result in the production

of information relevant to this proceeding. Subject to these objections and the general

objections, RAPA responds as follows: Ms. Fairchild-Hamilton's testimony speaks for

itself. Her testimony does not go into that level of detail.

In her analysis, Ms. Fairchild-Hamilton used the two known modifications to the

LG model – which is approved by the WUTC for calculating an OR for refuse hauling -

to generate results using Alaska Waste's proposed revenue requirements. She then

compared those results to results from the out-dated LG model to determine which of

the newer models produced a reasonable result. Ms. Fairchild-Hamilton's goal was to

determine which model produced the most reasonable results and then use that model

for recommending an appropriate OR for the Alaska Waste utilities.

(b)   Ms. Fairchild-Hamilton does not know how many companies were

removed from either the DuPont analysis or the BRG analysis by WUTC Staff.

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In her analysis, she used the two known modifications to the LG model – which

is approved by the WUTC for calculating an OR for refuse hauling - to generate results

using Alaska Waste's proposed revenue requirements. She then compared those results

to results from the out-dated LG model to determine which of the newer models

produced a reasonable result. Ms. Fairchild-Hamilton's goal was to determine which

model produced the most reasonable results and then use that model for recommending

an appropriate OR for the Alaska Waste utilities.

(c)   No. In her analysis, Ms. Fairchild-Hamilton used the two known

modifications to the LG model – which is approved by the WUTC for calculating an

OR for refuse hauling - to generate results using Alaska Waste's proposed revenue

requirements. She then compared those results to results from the out-dated LG model

to determine which of the newer models produced a reasonable result. Ms. Fairchild-

Hamilton's goal was to determine which model produced the most reasonable results

and then use that model for recommending an appropriate OR for the Alaska Waste

utilities.

(d)   No. In her analysis, Ms. Fairchild-Hamilton used the two known

modifications to the LG model – which is approved by the WUTC for calculating an

OR for refuse hauling - to generate results using Alaska Waste's proposed revenue

requirements. She then compared those results to results from the out-dated LG model

to determine which of the newer models produced a reasonable result. Ms. Fairchild-

Hamilton's goal was to determine which model produced the most reasonable results

and then use that model for recommending an appropriate OR for the Alaska Waste utilities.

(e)   OBJECTION to the extent this request seeks information outside the scope of the testimony of Ms. Fairchild-Hamilton and requires an analysis not previously performed. RAPA also objects to the request in that it seeks information that is readily and equally available to Alaska Waste in the form of Ms. Fairchild-Hamilton's testimony. Subject to these objections and the general objections, RAPA responds as follows: Yes. Companies with that level of ATO or Profit Margin are not representative of any regulated service that MS. Fairchild-Hamilton is aware of.

Answering Witness: Janet Fairchild-Hamilton.

Designated Hearing Witness: Janet Fairchild-Hamilton.

AW-AG-1-34.   Please refer to the Prefiled Testimony of Janet K. Fairchild-Hamilton at Q/A 54. Ms. Fairchild-Hamilton describes the Mahlanobis [sic] method used by Dr. Tyler.

(a)   Has Ms. Fairchild-Hamilton ever used the Mahalanobis method before? If so, please identify when and where she used it.

(b)   Has Ms. Fairchild-Hamilton conducted a review of the advantages and/or disadvantages of using the Mahalanobis method versus a strict cutoff of 400 ATO and 100 PM? If so, please identify when and where she reviewed it and provide a copy her review and the related work papers.

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Response: (a)   No. In her analysis, Ms. Fairchild-Hamilton used the two known modifications to the LG model – which is approved by the WUTC for calculating an OR for refuse hauling - to generate results using Alaska Waste's proposed revenue requirements. She then compared those results to results from the out-dated LG model to determine which of the newer models produced a reasonable result. Ms. Fairchild-Hamilton's goal was to determine which model produced the most reasonable results and then use that model for recommending an appropriate OR for the Alaska Waste utilities.

   (b)   No. In her analysis, Ms. Fairchild-Hamilton used the two known modifications to the LG model – which is approved by the WUTC for calculating an OR for refuse hauling - to generate results using Alaska Waste's proposed revenue requirements. She then compared those results to results from the out-dated LG model to determine which of the newer models produced a reasonable result. Ms. Fairchild-Hamilton's goal was to determine which model produced the most reasonable results and then use that model for recommending an appropriate OR for the Alaska Waste utilities.

Answering Witness: Janet Fairchild-Hamilton.

Designated Hearing Witness: Janet Fairchild-Hamilton.

IV.   Capital Structure

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AW-AG-1-35.　　　Please refer to the Prefiled Testimony of Janet K. Fairchild-Hamilton at Q/A 56. Ms. Fairchild-Hamilton describes that the DuPont Model relies on the Modigliani-Miller theorem. Please also refer to Exhibit JKF-7 at paragraphs 56-62.

　　(a)　　What is Ms. Fairchild-Hamilton's opinion regarding the proposition that the Modigliani-Miller theorem is an appropriate basis for the assumption of an invariant WACC?

　　(b)　　Does Ms. Fairchild-Hamilton agree that the Modigliani-Miller theorem has not achieved empirical support?

　　(c)　　If her answer to subpart (b) is anything other than an unqualified affirmative, please explain her rationale.

Response　　(a)　　OBJECTION to the extent this request requires an analysis not previously performed and outside the scope of Ms. Fairchild-Hamilton's testimony. Subject to these objections and the general objections, RAPA responds as follows: Because the relationships between capital structure, the cost of debt and the cost of equity as defined in the Modigliani-Miller theorem are consistent with the evaluation process Ms. Fairchild-Hamilton has observed in rate setting procedures throughout her career, she believe it is reasonable to apply its principles in setting the return allowance component of Alaska Waste's revenue requirements.

　　(b)　　OBJECTION to the extent the meaning of the phrase "achieved empirical support" is unclear and subject to more than one interpretation. RAPA also objects to the extent the request requires an analysis outside the scope of Ms. Fairchild-Hamilton's

testimony and requires an analysis not already performed. Subject to theses and the general objections, RAPA responds as follows: Ms. Fairchild-Hamilton does not have an opinion about whether the Modigliani-Miller theorem has achieved empirical support. It appears that some researchers believe that it has and others do not.

In her analysis, Ms. Fairchild-Hamilton used the two known modifications to the LG model – which is approved by the WUTC for calculating an OR for refuse hauling - to generate results using Alaska Waste's proposed revenue requirements. She then compared those results to results from the out-dated LG model to determine which of the newer models produced a reasonable result. Ms. Fairchild-Hamilton's goal was to determine which model produced the most reasonable results and then use that model for recommending an appropriate OR for the Alaska Waste utilities.

(c)   See responses to (a) and (b) above.

Answering Witness: Janet Fairchild-Hamilton.

Designated Hearing Witness: Janet Fairchild-Hamilton.

V.   **Model Recommendation**

AW-AG-1-36.   Please refer to the Prefiled Testimony of Janet K. Fairchild-Hamilton at Q/A 58. Ms. Fairchild-Hamilton states that interest rates and inflation rates are "low." Is she saying that margins should be lower for companies when inflation is "low" for an OR approach? If the answer is anything other than an unqualified affirmative, please explain her rationale.

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Response: Ms. Fairchild-Hamilton is saying that the reasonableness of a return allowance, regardless of how it is set, is dependent on and should reflect general economic conditions such as inflation and interest rates.

Answering Witness: Janet Fairchild-Hamilton.

Designated Hearing Witness: Janet Fairchild-Hamilton.

AW-AG-1-37. Please refer to Exhibit JKF-7 at Tables 2.4-2.5. Does Ms. Fairchild-Hamilton agree that historically margins and ROW [sic] have been higher for transportation companies in low-inflation periods? If the answer is anything other than an unqualified affirmative, please explain her rationale.

Response: Not in all instances. Table 2.5 shows that the ROE is nearly the same when the inflation rate was 7.47 percent and when it was 1.56 percent. Ms. Fairchild-Hamilton notes that, unlike the Alaska Waste utilities, transportation companies are generally not rate regulated by Public Utility Commissions.

Answering Witness: Janet Fairchild-Hamilton.

Designated Hearing Witness: Janet Fairchild-Hamilton.

AW-AG-1-38. Please refer to the Prefiled Testimony of Janet K. Fairchild-Hamilton at Q/A 58, page 44, lines 18-25 and page 45-1-2. Also refer to Exhibit JKF-11 at 2. Ms. Fairchild-Hamilton's testimony points to falling ROEs for regulated electric and gas utilities from 1980 to 2018 as a reason why we should expect to see lower returns for regulated waste haulers. Why is this an appropriate comparison to make?