

APPENDIX F

Ibbotson Data Used in the Analysis

STATISTICS FOR SIC CODE 131

Crude Petroleum and Natural Gas

This Industry Comprises 99 Companies

Industry Description

Establishments primarily engaged in operating oil and gas field properties. This includes all activities in the preparation of oil and gas up to the point of shipment from the producing property.

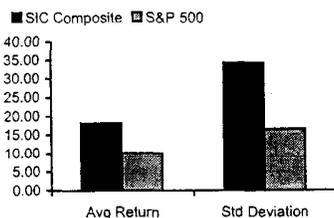
Sales (million\$)

Total	53,864
Average	544.1
Three Largest Companies	
OCCIDENTAL PETROLEUM CORP	13,985.0
ANADARKO PETROLEUM CORP	8,369.0
UNOCAL CORP	6,664.0
Three Smallest Companies	
STRATFORD AMERICAN CORP	0.4
CONTANGO OIL & GAS CO INC	0.3
FORELAND CORP	0.3

Total Capital (million\$)

Total	129,711
Average	1,310.2
Three Largest Companies	
ANADARKO PETROLEUM CORP	16,221.8
OCCIDENTAL PETROLEUM CORP	15,307.3
DEVON ENERGY CORP	14,319.7
Three Smallest Companies	
PETROMINERALS CORP	0.7
FORELAND CORP	0.6
PETROL INDUSTRIES INC	0.4

SIC vs. S&P 500 for Last 10 Years (%)



Number of Companies & Total Capital (billion\$)

S&P Debt Rating	Large Cap	Mid Cap	Low Cap	Micro Cap	Totals
AAA, AA, A	1	0	0	0	1 (companies)
	11.1	0.0	0.0	0.0	11.1 (capital)
BBB	5	3	0	0	8
	69.0	12.8	0.0	0.0	81.8
BB, B, CCC, CC, D	0	4	8	8	20
	0.0	12.7	9.8	3.4	25.9
Not Rated	0	0	7	63	70
	0.0	0.0	5.5	5.4	10.9
Totals	6	7	15	71	99
	80.1	25.5	15.2	8.8	129.7

Annualized Statistics for Last 10 Years (%)

	Avg Return	Std Deviation
S&P 500	10.24	16.59
SIC Composite	18.22	34.34
Large Composite	15.01	32.70
Small Composite	39.84	75.09

Compound Annual Equity Return (%)

	5 Years	10 Years
75th Percentile	3.06	9.09
Median	-8.36	4.00
25th Percentile	-24.14	-11.35
SIC Composite	10.72	12.31
Large Composite	6.55	10.81
Small Composite	45.66	-24.73

Sales, Income & Market Capitalization (billion\$)

	Operating Sales	Net Income	Equity Capital	Debt Capital
Current Yr.	53.9	21.1	5.2	85.7
Last Yr.	56.2	22.1	8.2	72.3
2 Yrs. Ago	31.0	10.2	1.7	83.1
3 Yrs. Ago	23.4	4.0	-4.3	54.9
4 Yrs. Ago	26.4	9.9	0.7	48.5

Growth Over Last 5 Years (%)

	Net Sales	Operating Income	Net Income
Median	19.46	23.45	24.39
SIC Composite	15.33	17.42	15.84
Large Composite	15.49	15.44	14.37
Small Composite	-20.10	15.21	2.03

Capital Structure Ratios (%)

Debt/Total Capital		Debt/MV Equity	
Latest	5-Year Avg	Latest	5-Year Avg
30.11	29.40	43.09	41.64
33.92	32.99	51.33	49.22
32.11	29.60	47.30	42.05
2.50	4.68	2.56	4.91

Distribution of Sales & Total Capital (million\$)

	Distribution of Sales		Total Capital	
	Latest	5-Year Avg	Latest	5-Year Avg
90th Percentile	896.7	736.4	2974.5	2,162.8
75th Percentile	207.0	135.7	689.2	540.5
Median	35.9	31.8	151.7	139.3
25th Percentile	6.1	4.2	25.7	26.7
10th Percentile	1.7	1.5	4.7	7.2

Margins (%)

	Operating Margin		Net Margin		Asset Turnover		Return on Inv. Cap.		Return on Assets		Return on Equity	
	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg
Median	46.88	36.34	8.48	0.09	40.45	35.46	4.17	0.65	3.72	0.03	5.62	0.04
SIC Composite	39.12	35.17	9.71	6.06	49.14	49.00	5.31	3.42	4.77	2.97	6.10	3.43
Large Composite	34.13	35.22	8.80	9.44	52.43	50.58	5.34	5.66	4.61	4.77	5.95	5.30
Small Composite	-30.34	-34.88	-51.82	-65.22	19.76	24.20	-16.07	-25.42	-10.24	-15.78	-5.35	-11.27

Equity Valuation Ratios (Multiples)

	Price/Earnings		Market/Book		Price/Sales		Price/Cash Flow		Price/Operating Income		Dividend Yield (% of Price)	
	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg
Median	17.80	NMF	1.40	1.69	1.54	2.14	NMF	NMF	4.18	5.28	0.00	0.00
SIC Composite	16.38	12.89	1.57	1.95	1.59	1.77	NMF	NMF	4.07	5.02	1.15	1.25
Large Composite	16.80	13.39	1.56	1.93	1.48	1.78	NMF	NMF	4.33	5.05	1.46	1.57
Small Composite	NMF	NMF	3.25	2.54	9.88	5.78	NMF	NMF	NMF	NMF	0.00	0.00

Growth Rates (%)

Cost of Equity Capital (%)

Weighted Average Cost of Capital (%)

Levered Betas

Unlevered Betas

	Analysts' Estimate	CAPM + Size Prem	CAPM	3-Factor Fama-French	Discounted Cash Flow 1-Stage	Discounted Cash Flow 3-Stage	CAPM + Size Prem	CAPM	3-Factor Fama-French	Discounted Cash Flow 1-Stage	Discounted Cash Flow 3-Stage	Raw Beta	Adjusted Beta	Adjusted Beta
Median	13.77	9.93	11.69	12.91	13.77	12.15	10.72	12.18	12.38	13.77	12.18	0.67	0.69	0.35
SIC Composite	13.77	10.48	11.20	12.26	13.87	9.50	10.41	10.91	11.64	12.75	9.74	0.69	0.76	0.57
Large Composite	12.97	10.35	10.35	11.59	13.94	12.40	9.58	9.58	10.44	12.05	10.99	0.68	0.75	0.57
Small Composite	13.77	10.27	13.57	8.14	13.77	6.50	10.28	13.54	8.18	13.75	6.56	0.39	0.74	0.73

STATISTICS FOR SIC CODE 291

Petroleum Refining

This Industry Comprises 11 Companies

Industry Description

Establishments primarily engaged in producing gasoline, kerosene, distillate fuel oils, residual fuel oils, and lubricants, through fractionation or straight distillation of crude oil, redistillation of unfinished petroleum derivatives, cracking or other processes. Establishments of this industry also produce aliphatic and aromatic chemicals as byproducts.

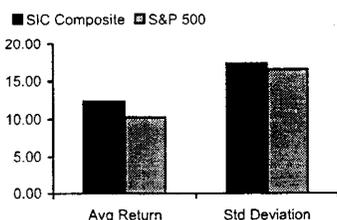
Sales (million\$)

Total	353,994
Average	32,181.3
Three Largest Companies	
EXXON MOBIL CORP	187,510.0
CHEVRONTExACO CORP	97,863.0
MARATHON OIL CORP	28,615.0
Three Smallest Companies	
HOLLY CORP	1,142.1
ARABIAN AMERICAN DEVELOPMENT	42.6
AMER INTL PETROLEUM CORP	18.3

Total Capital (million\$)

Total	345,192
Average	31,381.1
Three Largest Companies	
EXXON MOBIL CORP	226,364.4
CHEVRONTExACO CORP	91,382.1
MARATHON OIL CORP	10,673.6
Three Smallest Companies	
HOLLY CORP	307.4
AMER INTL PETROLEUM CORP	23.7
ARABIAN AMERICAN DEVELOPMENT	21.1

SIC vs. S&P 500 for Last 10 Years (%)



Number of Companies & Total Capital (billion\$)

S&P Debt Rating	Large Cap	Mid Cap	Low Cap	Micro Cap	Totals
AAA, AA, A	2	1	0	0	3 (companies)
	317.7	4.3	0.0	0.0	322.1 (capital)
BBB	1	2	0	0	3
	10.7	10.2	0.0	0.0	20.9
BB, B, CCC, CC, D	0	0	1	1	2
	0.0	0.0	0.5	1.3	1.9
Not Rated	0	0	0	3	3
	0.0	0.0	0.0	0.4	0.4
Totals	3	3	1	4	11
	328.4	14.6	0.5	1.7	345.2

Annualized Statistics for Last 10 Years (%)

	Avg Return	Std Deviation
S&P 500	10.24	16.59
SIC Composite	12.36	17.38
Large Composite	12.29	17.41
Small Composite	21.15	61.83

Compound Annual Equity Return (%)

	5 Years	10 Years
75th Percentile	5.84	10.41
Median	-3.06	6.07
25th Percentile	-18.83	0.64
SIC Composite	2.09	11.08
Large Composite	1.98	10.97
Small Composite	8.34	26.53

Sales, Income & Market Capitalization (billion\$)

	Operating Sales	Net Income	Equity Capital	Debt Capital
Current Yr.	354.0	53.2	21.9	306.2
Last Yr.	322.6	50.6	22.8	344.1
2 Yrs. Ago	235.1	27.6	10.9	383.1
3 Yrs. Ago	161.5	19.0	8.3	258.7
4 Yrs. Ago	187.1	26.8	12.7	244.2

Growth Over Last 5 Years (%)

	Net Sales	Operating Income	Net Income
Median	17.33	20.27	21.31
SIC Composite	13.67	16.65	15.19
Large Composite	13.34	16.17	13.54
Small Composite	11.19	18.06	25.34

Capital Structure Ratios (%)

Debt/Total Capital		Debt/MV Equity	
Latest	5-Year Avg	Latest	5-Year Avg
38.55	30.73	62.73	44.35
11.30	8.40	12.74	9.17
9.70	7.52	10.75	8.13
22.22	26.70	28.57	36.43

Distribution of Sales & Total Capital (million\$)

	Distribution of Sales		Total Capital	
	Latest	5-Year Avg	Latest	5-Year Avg
90th Percentile	97,863.0	47425.8	91382.1	71,635.8
75th Percentile	21,801.7	15899.0	8578.9	7,989.8
Median	5,136.8	3129.6	3745.8	3,181.2
25th Percentile	1,515.7	911.7	420.2	346.0
10th Percentile	42.6	28.7	23.7	71.8

Margins (%)

	Operating Margin		Net Margin		Asset Turnover		Return on Inv. Cap.		Return on Assets		Return on Equity	
	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg
Median	10.05	7.21	4.02	2.97	164.70	159.10	10.94	9.01	7.01	5.66	17.29	8.59
SIC Composite	15.03	14.06	6.18	6.08	145.87	132.44	11.78	10.88	9.02	8.05	7.15	4.89
Large Composite	15.85	14.90	6.48	6.49	141.96	127.44	12.14	11.16	9.20	8.27	6.86	4.78
Small Composite	11.00	7.71	3.68	0.94	205.68	169.11	12.57	2.47	7.57	1.60	16.06	2.98

Equity Valuation Ratios (Multiples)

	Price/Earnings		Market/Book		Price/Sales		Price/Cash Flow		Price/Operating Income		Dividend Yield (% of Price)	
	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg
Median	5.78	11.64	1.40	1.64	0.23	0.34	15.46	29.24	2.41	3.41	1.08	1.10
SIC Composite	13.99	14.32	2.09	2.80	0.86	1.24	18.62	27.70	5.75	8.84	0.25	0.59
Large Composite	14.57	14.97	2.18	2.88	0.94	1.36	19.40	27.82	5.96	9.11	0.20	0.55
Small Composite	6.23	6.09	1.01	1.19	0.23	0.32	5.86	NMF	2.08	4.12	2.25	2.21

Growth Rates (%)

Cost of Equity Capital (%)

Weighted Average Cost of Capital (%)

Levered Betas

Unlevered Betas

	Analysts' Estimate	CAPM	3-Factor Fama-French	Discounted Cash Flow	CAPM	3-Factor Fama-French	Discounted Cash Flow	Raw Beta	Adjusted Beta	Adjusted Beta				
	Median	8.05	9.49	10.96	11.70	12.05	11.30	9.44	9.57	10.87	11.05	10.22	0.63	0.63
SIC Composite	7.81	8.31	8.31	10.03	8.06	13.20	8.16	8.16	9.71	7.93	12.57	0.48	0.47	0.44
Large Composite	7.70	8.27	8.27	9.99	8.14	13.10	8.13	8.13	9.70	8.01	12.53	0.47	0.47	0.44
Small Composite	7.81	8.55	11.85	16.99	8.03	9.40	9.01	11.79	16.12	8.57	9.72	0.52	0.51	0.43

STATISTICS FOR SIC CODE 131

Crude Petroleum and Natural Gas

This Industry Comprises 93 Companies

Industry Description

Establishments primarily engaged in operating oil and gas field properties. This includes all activities in the preparation of oil and gas up to the point of shipment from the producing property.

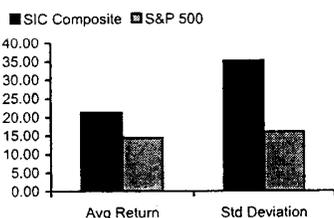
Sales (million\$)

Total	52,333
Average	562.7
Three Largest Companies	
OCCIDENTAL PETROLEUM CORP	13,985.0
ANADARKO PETROLEUM CORP	8,369.0
UNOCAL CORP	6,664.0
Three Smallest Companies	
PETROMINERALS CORP	0.5
CONTANGO OIL & GAS CO INC	0.3
FORELAND CORP	0.3

Total Capital (million\$)

Total	131,853
Average	1,417.8
Three Largest Companies	
ANADARKO PETROLEUM CORP	19,193.0
OCCIDENTAL PETROLEUM CORP	15,530.5
DEVON ENERGY CORP	14,014.4
Three Smallest Companies	
ALTEX INDUSTRIES INC	1.1
FORELAND CORP	0.6
PETROL INDUSTRIES INC	0.4

SIC vs. S&P 500 for Last 10 Years (%)



Number of Companies & Total Capital (billion\$)

S&P Debt Rating	Large Cap	Mid Cap	Low Cap	Micro Cap	Totals
AAA, AA, A	1	0	0	0	1 (companies)
	10.3	0.0	0.0	0.0	10.3 (capital)
BBB	5	3	0	0	8
	74.1	12.9	0.0	0.0	87.0
BB, B, CCC, CC, D	0	5	6	6	17
	0.0	14.1	6.7	2.3	23.2
Not Rated	0	0	10	57	67
	0.0	0.0	6.8	4.5	11.4
Totals	6	8	16	63	93
	84.4	27.0	13.5	6.9	131.9

Annualized Statistics for Last 10 Years (%)

	Avg Return	Std Deviation
S&P 500	14.36	15.93
SIC Composite	21.30	35.15
Large Composite	18.18	33.74
Small Composite	42.34	78.28

Compound Annual Equity Return (%)

	5 Years	10 Years
75th Percentile	10.44	15.94
Median	0.15	6.55
25th Percentile	-17.76	-7.51
SIC Composite	17.28	15.39
Large Composite	12.18	13.81
Small Composite	34.63	-3.59

Sales, Income & Market Capitalization (billion\$)

	Operating Sales	Net Income	Equity Capital	Debt Capital
Current Yr.	52.3	22.8	5.4	90.5
Last Yr.	47.1	20.3	6.9	89.5
2 Yrs. Ago	25.6	7.4	-0.9	57.4
3 Yrs. Ago	22.2	6.5	-1.4	43.6
4 Yrs. Ago	24.8	9.5	1.3	62.3

Growth Over Last 5 Years (%)

	Net Sales	Operating Income	Net Income
Median	23.10	25.43	28.89
SIC Composite	16.55	21.88	20.77
Large Composite	15.98	20.25	15.66
Small Composite	-2.64	-12.39	-14.97

Capital Structure Ratios (%)

Debt/Total Capital		Debt/MV Equity	
Latest	5-Year Avg	Latest	5-Year Avg
25.90	29.59	34.95	42.03
27.79	32.38	38.49	47.89
28.90	30.26	40.65	43.39
3.27	3.58	3.38	3.71

Distribution of Sales & Total Capital (million\$)

	Distribution of Sales		Total Capital	
	Latest	5-Year Avg	Latest	5-Year Avg
90th Percentile	872.3	644.2	3170.0	2,277.3
75th Percentile	211.3	127.1	717.4	493.4
Median	44.6	29.9	148.3	109.0
25th Percentile	6.4	3.8	28.3	24.4
10th Percentile	1.9	1.4	6.0	8.4

Margins (%)

	Operating Margin		Net Margin		Asset Turnover		Return on Inv. Cap.		Return on Assets		Return on Equity	
	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg
Median	51.97	39.57	15.19	2.04	42.85	35.46	5.73	1.42	6.22	1.14	6.30	1.42
SIC Composite	43.53	38.66	10.32	6.50	49.76	46.15	4.83	3.49	5.14	3.00	5.99	3.56
Large Composite	40.09	36.83	8.86	9.32	52.52	50.53	4.95	5.61	4.65	4.71	5.54	5.51
Small Composite	-29.74	-41.07	-50.36	-69.41	16.84	21.45	1.17	-22.41	-8.48	-14.89	-9.35	-10.60

Equity Valuation Ratios (Multiples)

	Price/Earnings		Market/Book		Price/Sales		Price/Cash Flow		Price/Operating Income		Dividend Yield (% of Price)	
	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg
Median	15.87	70.39	1.83	1.65	1.78	2.40	NMF	NMF	4.29	5.33	0.00	0.00
SIC Composite	16.69	16.35	1.74	1.87	1.72	1.83	NMF	NMF	3.96	4.73	1.11	1.29
Large Composite	18.04	13.79	1.71	1.86	1.60	1.69	42.68	NMF	3.99	4.60	1.39	1.60
Small Composite	NMF	NMF	1.46	2.33	5.38	6.54	NMF	NMF	NMF	NMF	0.00	0.00

Growth Rates (%)

Cost of Equity Capital (%)

Weighted Average Cost of Capital (%)

	Analysts' Estimate	CAPM		3-Factor Fama-French		Discounted Cash Flow		CAPM		3-Factor Fama-French		Discounted Cash Flow		Levered Betas		Unlevered Betas	
		CAPM + Size Prem	3-Stage	1-Stage	3-Stage	CAPM + Size Prem	3-Stage	1-Stage	3-Stage	Raw Beta	Adjusted Beta	Adjusted Beta					
Median	16.13	10.71	12.78	14.05	16.13	12.60	11.29	13.13	13.86	15.76	12.69	0.58	0.64	0.39	0.58	0.58	
SIC Composite	16.13	11.60	12.32	13.65	16.23	10.00	11.44	11.95	12.89	14.72	10.30	0.68	0.75	0.58	0.66	0.73	
Large Composite	15.15	11.48	11.48	12.99	16.30	13.30	10.90	10.90	11.97	14.32	12.20	0.66	0.73	0.57	0.54	0.76	
Small Composite	16.13	11.71	15.01	11.64	16.13	6.50	11.72	14.99	11.65	16.10	6.54	0.54	0.76	0.76			

STATISTICS FOR SIC CODE 131

Crude Petroleum and Natural Gas

This Industry Comprises 95 Companies

Industry Description

Establishments primarily engaged in operating oil and gas field properties. This includes all activities in the preparation of oil and gas up to the point of shipment from the producing property.

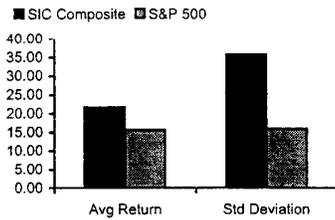
Sales (million\$)

Total	33,880
Average	356.6
Three Largest Companies	
UNOCAL CORP	8,914.0
ANADARKO PETROLEUM CORP	5,686.0
BURLINGTON RESOURCES INC	3,147.0
Three Smallest Companies	
OCEANIC EXPLORATION CO	0.4
PETROMINERALS CORP	0.4
DTVN HOLDINGS INC	0.2

Total Capital (million\$)

Total	108,578
Average	1,142.9
Three Largest Companies	
ANADARKO PETROLEUM CORP	19,974.4
BURLINGTON RESOURCES INC	11,743.5
UNOCAL CORP	11,318.1
Three Smallest Companies	
ALTEX INDUSTRIES INC	1.6
PETROMINERALS CORP	1.3
PETROL INDUSTRIES INC	0.4

SIC vs. S&P 500 for Last 10 Years (%)



Number of Companies & Total Capital (billion\$)

S&P Debt Rating	Large Cap	Mid Cap	Low Cap	Micro Cap	Totals
AAA, AA, A	3	0	0	0	3 (companies)
	30.9	0.0	0.0	0.0	30.9 (capital)
BBB	3	3	0	0	6
	37.1	8.9	0.0	0.0	46.0
BB, B, CCC, CC, D	0	7	5	6	18
	0.0	15.2	3.6	1.6	20.4
Not Rated	0	1	9	58	68
	0.0	1.3	5.1	4.8	11.3
Totals	6	11	14	64	95
	68.0	25.4	8.7	6.4	108.6

Annualized Statistics for Last 10 Years (%)

	Avg Return	Std Deviation
S&P 500	15.50	15.86
SIC Composite	21.63	35.71
Large Composite	17.62	34.92
Small Composite	23.35	56.72

Compound Annual Equity Return (%)

	5 Years	10 Years
75th Percentile	19.17	14.99
Median	4.41	5.31
25th Percentile	-9.91	-2.93
SIC Composite	108.44	15.32
Large Composite	13.17	12.97
Small Composite	64.26	25.92

Sales, Income & Market Capitalization (billion\$)

	Operating Sales	Operating Income	Net Income	Equity Capital	Debt Capital
Current Yr.	33.9	16.7	5.4	80.6	28.0
Last Yr.	18.4	5.7	-1.9	50.6	26.6
2 Yrs. Ago	15.8	5.3	-1.6	37.6	21.4
3 Yrs. Ago	17.0	8.0	0.9	52.3	17.0
4 Yrs. Ago	14.2	6.5	1.4	43.9	12.4

Growth Over Last 5 Years (%)

	Net Sales	Operating Income	Net Income
Median	19.62	24.07	35.75
SIC Composite	18.58	30.22	NMF
Large Composite	19.42	30.09	125.04
Small Composite	-23.96	NMF	-0.50

Capital Structure Ratios (%)

Debt/Total Capital		Debt/MV Equity	
Latest	5-Year Avg	Latest	5-Year Avg
26.19	30.72	35.48	44.35
20.86	29.57	26.35	41.99
22.75	27.33	29.44	37.61
0.00	3.53	0.00	3.66

Distribution of Sales & Total Capital (million\$)

	Distribution of Sales		Total Capital	
	Latest	5-Year Avg	Latest	5-Year Avg
90th Percentile	708.2	395.9	2728.4	1,396.6
75th Percentile	134.5	108.3	622.0	444.3
Median	26.6	21.3	152.2	96.0
25th Percentile	4.4	4.6	31.1	24.4
10th Percentile	1.3	1.5	6.5	9.7

Margins (%)

	Operating Margin		Net Margin		Asset Turnover		Return on Inv. Cap.		Return on Assets		Return on Equity	
	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg
Median	41.37	29.82	9.12	-5.31	33.97	32.01	4.11	-1.05	3.27	-1.62	4.87	-1.93
SIC Composite	49.25	42.39	15.84	4.18	50.15	40.78	9.26	1.89	7.94	1.71	7.14	1.72
Large Composite	47.01	43.66	16.58	8.77	54.72	43.57	9.34	4.26	9.07	3.82	7.59	3.68
Small Composite	-114.90	-36.68	-137.54	-58.38	10.61	26.37	2.23	-21.79	-14.59	-15.39	-16.57	-14.00

Equity Valuation Ratios (Multiples)

	Price/Earnings		Market/Book		Price/Sales		Price/Cash Flow		Price/Operating Income		Dividend Yield (% of Price)	
	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg	Latest	5-Year Avg
Median	20.55	NMF	2.00	1.76	3.43	2.68	NMF	NMF	5.72	6.99	0.00	0.00
SIC Composite	14.01	10.17	2.21	2.13	2.22	2.43	66.34	NMF	4.51	5.73	0.65	0.87
Large Composite	13.17	8.03	1.99	2.07	2.18	2.38	31.60	NMF	4.65	5.46	0.79	1.05
Small Composite	NMF	NMF	0.92	1.65	8.30	4.17	NMF	NMF	NMF	NMF	0.00	0.28

Growth Rates (%)

Cost of Equity Capital (%)

Weighted Average Cost of Capital (%)

Levered Betas

Unlevered Betas

	Analysts' Estimate	CAPM	CAPM + Size Prem	3-Factor Fama-French	Discounted Cash Flow	CAPM	3-Factor Fama-French	Discounted Cash Flow	Raw Beta	Adjusted Beta	Adjusted Beta			
				1-Stage	3-Stage	CAPM + Size Prem		1-Stage	3-Stage					
Median	17.94	10.39	11.88	13.72	17.94	11.15	10.74	12.20	13.53	16.64	10.85	0.60	0.63	0.41
SIC Composite	17.94	12.16	12.74	30.83	18.02	8.10	11.65	12.09	25.89	16.12	8.55	3.59	0.85	0.69
Large Composite	16.26	11.12	11.12	11.74	18.05	10.90	10.52	10.52	11.00	15.88	10.35	0.63	0.71	0.60
Small Composite	17.94	12.22	14.84	15.26	17.94	6.50	12.17	14.71	15.12	17.72	6.62	1.05	0.86	0.83

Exhibit 4: Capital Structure Ratios - October 2002

Debt/Total Capital	17%
Equity/Total Capital	83%
Debt/Market Value of Equity	20%

Total MV of Equity	758,502.17
Total Book Debt	152,241.98
Total Capital	<u>910,744.16</u>

Company Name	Book Value of Debt	Market Value October-02	Total Capital	Debt to Total Capital
AMERADA HESS CORP	5,665.00	4,577.70	10,242.70	0.55
ANADARKO PETROLEUM CORP	5,153.00	11,068.81	16,221.81	0.32
APACHE CORP	-2,550.95	7,773.77	10,324.73	0.25
BP PLC -ADS	21,438.00	143,771.39	165,209.39	0.13
BURLINGTON RESOURCES INC	4,337.00	8,293.56	12,630.56	0.34
CHEVRONTEXACO CORP	17,418.00	72,233.77	89,651.77	0.19
CONOCOPHILLIPS	9,339.00	32,815.05	42,154.05	0.22
DEVON ENERGY CORP	6,590.00	7,902.80	14,492.80	0.45
DOMINION RESOURCES INC	16,848.00	14,665.39	31,513.39	0.53
EOG RESOURCES INC	1,003.55	4,265.86	5,269.41	0.19
EXXON MOBIL CORP	10,802.00	227,455.47	238,257.47	0.05
KERR-MCGEE CORP	4,574.00	4,366.31	8,940.31	0.51
MARATHON OIL CORP	3,647.00	6,475.15	10,122.15	0.36
OCCIDENTAL PETROLEUM CORP	4,608.00	10,758.66	15,366.66	0.30
ROYAL DUTCH PETROLEUM -ADR	3,493.00	91,699.23	95,192.23	0.04
SUNOCO INC	1,444.00	2,288.10	3,732.10	0.39
TESORO PETROLEUM CORP	1,146.90	210.625	1,357.53	0.84
TOTAL FINA ELF S A -ADR	13,111.17	96,421.34	109,532.52	0.12
UNOCAL CORP	3,428.00	6,762.51	10,190.51	0.34
VALERO ENERGY CORP	3,683.41	3,725.61	7,409.01	0.50
WILLIAMS COS INC	11,962.00	971.044	12,933.04	0.92

Exhibit 5: Peer Group Companies, Industry Tax Rate, Effective Company Tax Rates (2001)

Industry Weighted Average Effective Tax Rate

29.64%

Company	Effective Tax Rates
AMERADA HESS CORP	6.79%
ANADARKO PETROLEUM CORP	35.00%
APACHE CORP	1.38%
BP PLC -ADS	35.04%
BURLINGTON RESOURCES INC	31.78%
CHEVRONTEXACO CORP	35.00%
CONOCOPHILLIPS	35.11%
DEVON ENERGY CORP	33.89%
DOMINION RESOURCES INC	21.26%
EOG RESOURCES INC	35.64%
EXXON MOBIL CORP	35.00%
KERR-MCGEE CORP	4.67%
MARATHON OIL CORP	35.07%
OCCIDENTAL PETROLEUM CORP	35.01%
ROYAL DUTCH PETROLEUM -ADR	1.62%
SUNOCO INC	16.20%
TESORO PETROLEUM CORP	32.63%
TOTAL FINA ELF S A -ADR	35.21%
UNOCAL CORP	3.95%
VALERO ENERGY CORP	34.69%
WILLIAMS COS INC	8.01%

Exhibit 2: Industry Size Premium - October 2002

Industry Size Premium (%) 0.044

Company Name	Market Value October-02	Portfolio Decile	Size Premium (%)
EXXON MOBIL CORP	227,455,469,000	1	0
BP PLC -ADS	143,771,391,000	1	0
TOTAL FINA ELF S A -ADR	96,421,344,000	1	0
ROYAL DUTCH PETROLEUM -ADR	91,699,227,000	1	0
CHEVRONTEXACO CORP	72,233,773,000	1	0
CONOCOPHILLIPS	32,815,051,000	1	0
DOMINION RESOURCES INC	14,665,392,000	1	0
ANADARKO PETROLEUM CORP	11,068,814,000	2	0.33
OCCIDENTAL PETROLEUM CORP	10,758,663,000	2	0.33
BURLINGTON RESOURCES INC	8,293,560,000	2	0.33
DEVON ENERGY CORP	7,902,796,000	2	0.33
APACHE CORP	7,773,774,000	2	0.33
UNOCAL CORP	6,762,513,000	2	0.33
MARATHON OIL CORP	6,475,154,000	2	0.33
AMERADA HESS CORP	4,577,704,000	3	0.59
KERR-MCGEE CORP	4,366,313,000	3	0.59
EOG RESOURCES INC	4,265,856,000	3	0.59
VALERO ENERGY CORP	3,725,605,000	3	0.59
SUNOCO INC	2,288,104,000	4	0.83
WILLIAMS COS INC	971,044,000	6	1.36
TESORO PETROLEUM CORP	210,625,000	9	2.41
	758,502,172,000		

Exhibit 3: Cost of Debt - October 2002

Industry Cost of Debt (%) 6.32

Company Name	Domestic LT ICR/S&P	Ratings from Compustat	Lehman Brother's LT Bond Yield - October 2002
EXXON MOBIL CORP	2	AAA	5.84
BP PLC -ADS	4	AA+	6.11
CHEVRONTEXACO CORP	5	AA	6.11
TOTAL FINA ELF S A -ADR	5	AA	6.11
APACHE CORP	9	A-	6.61
CONOCOPHILLIPS	9	A-	6.61
ANADARKO PETROLEUM CORP	10	BBB+	8.14
BURLINGTON RESOURCES INC	10	BBB+	8.14
DOMINION RESOURCES INC	10	BBB+	8.14
EOG RESOURCES INC	10	BBB+	8.14
MARATHON OIL CORP	10	BBB+	8.14
UNOCAL CORP	10	BBB+	8.14
AMERADA HESS CORP	11	BBB	8.14
DEVON ENERGY CORP	11	BBB	8.14
KERR-MCGEE CORP	11	BBB	8.14
OCCIDENTAL PETROLEUM CORP	11	BBB	8.14
SUNOCO INC	11	BBB	8.14
VALERO ENERGY CORP	11	BBB	8.14
TESORO PETROLEUM CORP	15	BB-	11.08
WILLIAMS COS INC	16	B+	13.2

**Discussion of Rate of Return Issues
Associated with Computation of
Transportation Allowances in
Non-Arm's Length Transactions
On Federal Leases**

By

**Marshall Rose
Chief, Economics Division
February 18, 2000**

Executive Summary

Industry has proposed that MMS employ a weighted average cost of capital measure in computing transportation allowances for operators who own their own pipelines. This approach, when applied to transportation allowances, implies that recent returns, financing costs, and the current allocation of capital between debt and equity will essentially continue into the near future. If this assumption is violated for any one of these elements, then the weighted cost of capital approach might not necessarily be appropriate.

The philosophy held by MMS in implementing the current program is that the actual costs needed to construct the transportation facilities should be used as inputs in determining the transportation allowance. In contrast, the weighted cost of capital approach focuses more on the potential use of hypothetical proceeds measured by the underdepreciated value of the facilities, for investing or refinancing existing debt. Which model is most appropriate depends, in part, on the extent to which sales of facilities are feasible and actually take place, and if so, whether the sale proceeds are reasonably approximated by the amount of undepreciated capital. Again, if these situations are not realistic, the weighted average cost of capital approach might not be appropriate.

Under our current program, MMS uses the BBB industrial bond rate. This rate typically falls between the cost of borrowing for the type of firms involved, i.e., large integrated oil and gas companies, and the return that these firms are expected to earn on their capital investments. As such, the choice of the BBB bond rate for the cost of capital in the current program is entirely reasonable.

Companies can be expected to finance investments at the margin in the least costly manner. The fact that there has developed over time a combination of debt and equity financing, mostly for reasons and activities far removed from the transportation system, should generally not influence the allowed cost for royalty purposes.

The industry proposal appears flawed both conceptually and quantitative as well. They calculate a weighted average return of 16.2%, and indicate that it represents 2.2 times the BBB bond rate. Using the same sources and essentially the same data, we find the weighted return to be around 10% during the past 2 years, which fell between 1.2 and 1.4 times the BBB bond rate.

Summary of Findings

1. A compelling case for incorporating the return to equity in computing transportation allowance has not been made by the commentaries to the proposed rule.
2. However, if we use the weighted average cost of capital approach, we should employ industry sector Use SIC 291 (not SIC 131 as industry proposed).
3. The appropriate figures to represent the after-tax return for SIC 291 taken from the industry cited source Ibbotson Associates, are:

	<u>1999</u>	<u>1998</u>
Equity	9.1%	9.8%
Debt	4.9%	4.5%

(Not 13.1 % as proposed by Industry for Equity.)

4. The appropriate marginal federal corporate tax rate for SIC 291 is 19%.

(Not the nominal tax rate of 35% proposed by industry.)

5. The proportion of existing debt to total capital for SIC 291 is small. However, recent new ventures have been financed primarily through debt. We suggest instead using the industry proposed debt proportion of 30%; this still reflects the sources of funds for old investments more than new ones.
6. From 1-4 above, the weighted average cost of capital is computed to be 9.7% in 1999, and 10.1% in 1998.

7. The average BBB bond rate was 8.0% in 1999, and 7.1% in 1998. Therefore, the ratio of the weighted capital cost of capital to the BBB bond rate was 1.2 in 1999 and 1.4 in 1998. A selection within this range if the weighted cost of capital measure is used, appears more appropriate than the multiple of 2 proposed by the industry.
8. The combined effects of allowing a higher return on undepreciated capital, while permitting new pipeline owners to apply this return to the purchase price of their asset (as modified in the proposed rule), could lead to a higher proportion of production being transported under non-arm's length transactions. (The current proportion is guessed to be about 20% by RMB staff.)
9. MMS collects \$3 billion in royalties annually. Assume that 20% of these receipts are generated by lessees who own their own pipelines; and doubling the allowed rate of return as proposed by industry lowers the effective royalty rate by one percent point. Given a current composite lease royalty rate of say, 14%, it follows that the reduction in royalty receipts would be about \$43 million.

Industry FR Comments, My Responses

Industry Comment: MMS should use a weighted average industry cost of capital (WACC) in conjunction with a BBB bond rate to determine the transportation allowance.

Response: If industry can borrow at a lower rate than the opportunity cost of equity, it is not clear why we should allow inclusion of the return to equity from other projects as a cost for the purposes of computing a transportation allowance.

If the return on equity is substantially greater than the cost of debt, it is less likely that the WACC will accurately reflect the near future financing characteristics of the transportation system. In recent years, the industry has relied more heavily on debt financing than in previous years.

There is no single, generally accepted accurate measure of the industry-required rate of return on equity.

Most methods used to estimate return on equity employ inputs such as stock price, dividends, and projected earning growth, which are highly volatile.

Those equity and debt measures that are available in the literature relate to industry sectors that are less than a perfect proxy for operators who are also owners of their offshore transportation systems.

The returns that the company would accept to build and operate the transportation system involve much less risk than other activities, e.g., wildcat drilling.

If we did apply a weighted measure, the BBB bond rate would not be the appropriate input for the cost of debt used in the index.

Industry Comment: The weighted average cost of capital needs to be expressed in before-tax terms and reflect the nominal corporate tax rate of 35%.

Response: If we accept the WACC as the appropriate way to measure the cost of financing the transportation system, (or the opportunity cost of not selling it), then because royalties are paid before tax, the deductions should be expressed in before-tax terms as well.

Typically we obtain measures of equity in after-tax terms and debt in before-tax terms. Therefore, some adjustment in the after-tax equity component may be called for.

However, the tax rate used in converting from after-tax to before tax returns is not necessarily equivalent to the nominal rate of 35%. This is the case because of the presence of tax credits, tax shelters, carry-over losses, accelerated depreciation, write-offs, etc. The proper figure is the marginal tax rate.

For the industry sector we believe is most similar to the class of lease-hold transportation system owners on the OCS, SIC 291, the publication cited by the API commentaries (issued by Ibbotson Associates) indicates the marginal tax rate to be 19.1%, for oil and gas integrated companies. In a study conducted for USGS of 1223 leases on the OCS, Professor Walter Mead of U.C. Berkeley found the marginal tax rate to be 18.4%.

Industry Comment:

We can estimate the before-tax return on equity by setting the ratio of after-tax to before-tax returns equal to one minus the (nominal) corporate tax rate.

Response:

This simple formula used to obtain before-tax returns is only an approximation. In fact, in many cases it tends to overstate the before-tax return. The faster that depreciation is taken relative to the generation of net income, the less accurate is the formula and the smaller is the before-tax return. In the case of expensing the investment, the before and after-tax returns are equivalent. In situations where Congress has reduced the tax rate over time, it is possible to obtain a before tax return that is less than the after tax return.

Industry Comment:

The industry WACC should be based on figures taken from SIC 131 companies, e.g., Devon, Vastar, Apache, Burlington, Enron, Noble, Pogo, Tatham, etc.

Response:

We have identified 17 companies that are associated with requesting exceptions to use FERC tariffs in lieu of actual costs. Of them, the following 8 have been identified as SIC 291 companies: Amerida Hess, Chevron, Marathon, Exxon, Mobil, Phillips, Shell, and Texaco. Those companies identified as SIC 131 firms are Devon and Vastar.

We are not sure about BP exploration and Conoco, but wouldn't be surprised if they were SIC 291 firms as well.

Thus, SIC 291 seems much superior to SIC 131 as the industry sector to use as a proxy for companies operating their own offshore transportation systems.

Industry Comment.

For 1999, the after-tax cost of equity was 13.1% the BBB bond rate was 7.4%.

Response:

The industry calculations involve taking an average across 4 different computational methods applied to oil and gas extraction companies, SIC 131. We believe that oil and gas integrated companies represent a better set of firms to include in the calculations.

The 1999 after-tax return to equity for this sector, in the data set provided by industry, is 10.22%. But, this measure represents the estimates from a different source and uses a capital asset pricing model.

Instead we returned to Ibbotson, who uses a single stage discounted cash flow model. We infer from that source that the 1999 after-tax equity rate of return was 9.1%. Also, we find the BBB bond rate for 1999 was about 8.0% rather than 7.4%.

Industry Comment:

The debt portion of the WACC should be represented by the BBB bond rate.

Response:

The BBB bond rate should not necessarily be used in computing the WACC. The Ibbotson data suggest a before-tax return on debt for SIC 291 companies of 6.1%. This debt rate is more representative of the cost of borrowing than the BBB bond rate for the set of SIC 291 companies, which we believe is the best composite available in the literature as a reflection of offshore companies that carry out their own transportation.

Industry Comments: For 1999, the weighted average cost of capital as 16.2%, which was 2.2 times the BBB bond rate.

Response: Based on the modifications discussed in previous responses, we find the weighted cost of capital to be 9.7% in 1999, and 10.1% in 1998. These results were 1.2 and 1.4 times the applicable BBB bond rate in those years, respectively.

Gibbs Tschudy, Deborah

From: Rose, Marshall
Sent: Wednesday, July 02, 2003 1:01 PM
To: Gibbs Tschudy, Deborah
Cc: Schantz, Radford
Subject: FW: revised cost of cap

Debbie: Attached is work I promised that we'd do for you on the cost of capital for determining transportation allowances in situations involving the non-arms length shipment of oil. Looking back, these findings are seen to be consistent (fortunately) with the earlier work I did for you over 3 years ago on a similar issue relating to gas transportation.

Regards,

Marshall Rose

COST OF CAPITAL FOR PIPELINES

Summary

Assuming that pipeline businesses provide the best proxy for non-arms-length transportation of oil, two sources of data for the cost of capital are presented. Energy Department data covering oil and gas pipelines imply that the return on investment (which approximates the cost of capital) for pipelines averages roughly the same as the BBB rate. In contrast, Ibbotson data for gas pipelines and distributors imply that, for the first quarter of 2003, the cost of capital for pipelines is a multiple as low as 1.1 and as high as 1.5 of the BBB rate, depending on detailed assumptions. Using those assumptions we feel most comfortable with, the multiple we find to be appropriate for this data set is 1.3.

Background

The context of the paper is ongoing debate about an administratively simple rule for cost of capital in non-arms-length transportation of oil. While MMS has been suggesting the BBB bond rate, or possibly a multiple that is 1.3 times the BBB rate, the API argues that the cost of capital averages a larger multiple of the BBB rate, such as 1.6.

In a recent research paper, "Capital Cost of Pipeline Assets," API characterizes the relevant concept for cost of capital of a non-independent pipeline as the weighted average cost of capital (WACC), which averages the cost of equity and debt of the overall firm (regardless of specific financing arranged for the pipeline). Importantly, the "overall firm" in the API analysis is assumed to be the oil production industry. This industry comprises large integrated corporations as well as small, independent producers. Financial data and cost of capital estimates are reported by Ibbotson for the oil industry as represented by two standard industrial sectors, SIC 131 – typically smaller and nonintegrated – and SIC 291 – typically the integrated majors, plus some refiners that lack upstream affiliates. For both sectors, API computes the ratio of WACC to the BBB bond rate, finding that the multiple is about 1.8 for SIC 131 and 1.6 for SIC 291 for a recent point in time (2002 through October). They also compute the ratio for years 1997 to 2002 and show its degree of variation from year to year.

The API paper, which is based on contracted research by Ibbotson, is technically excellent as regards cost of capital to oil and gas producers. However, its relevance to the issue about valuing non-arms-length pipeline transactions is doubtful. More relevant would be estimates of the cost of capital for these companies' pipeline business. In this paper, I draw on two sources of information, EIA and Ibbotson, about the pipeline business specifically.

EIA data

EIA publishes return on investment (roi) for lines of business of its Financial Reporting System, which samples the major oil corporations. Roi is one possible indicator of cost of capital. As

seen from the table below, the roi for the pipelines business of these companies averages well below the roi on their US production business for most years and size classes. The (post tax) roi on the pipelines is 6.0% and 9.7% for the two years shown.

Furthermore, the roi of the pipelines averages about the BBB rate, which for the same two years is roughly 7% after adjusting for taxes. (Specifically, the BBB rate on pre-tax basis averaged 8.5% for 2000 and 2001. Tax adjustment is explained below.) Also, most pipelines have BBB rating for their debt capital (*NG Trends '95*).

While these EIA data might suffice to settle the main point in dispute, they are not directly comparable with Ibbotson data, being based on a different sample and different details of methodology. Thus we proceed next to consider the Ibbotson data.



Table B8. Return on Investment for Lines of Business for FRS Companies Ranked by Total Energy Assets, 2000-2001
 (Percent)

Line of Business	All FRS		Top Four		Five through Twelve		All Other	
	2000	2001	2000	2001	2000	2001	2000	2001
Petroleum	13.9	12.2	16.1	12.5	10.6	11.8	11.9	12.2
U.S. Petroleum	13.2	13.1	16.7	12.7	9.6	12.7	11.7	14.5
Oil and Gas Production	17.7	13.1	20.4	12.3	18.5	14.0	11.0	13.3
Refining/Marketing	9.6	14.5	11.1	16.7	-5.5	10.9	13.4	15.1
Pipelines	6.0	9.7	7.9	8.2	5.3	11.0	7.1	25.7
Foreign Petroleum	15.1	10.9	15.6	12.3	14.4	9.0	12.3	7.7

Note: Return on investment measured as contribution to net income/net investment in place.

Source: Energy Information Administration, Form EIA-28 (Financial Reporting System).

Ibbotson

Ibbotson publishes cost of capital for gas pipelines and distributors, but not oil pipelines. To use Ibbotson data to estimate WACC for company's oil pipeline segments, we must assume that oil pipelines have about the same cost of capital as gas pipelines and distributors. Certainly we acknowledge that there are differences between gas and oil pipelines, including differences in the regulatory regimes they operate under. Nevertheless, we make the plausible assumption that the gas pipeline WACC is a measure more relevant to the present topic than the oil production WACC.

The published Ibbotson data are aggregated in a way that complicates investigating pipeline cost of capital. SIC 492 combines pipelines and local distribution companies (l.d.c.'s). Apparently the pipelines tend to have a slightly higher cost of capital (i.e., lower rating) than the l.d.c.'s. According to EIA (*NG Trends '95*), most pipelines have BBB rating, whereas most l.d.c.'s have A rating.

Ibbotson publishes data for sector 492 and for one of its subsectors, SIC 4924 (which includes the l.d.c.'s specifically). The relation of the definitions of SIC 492 and its various subsectors are shown in the Attachment on the next page. Inasmuch as Ibbotson publishes data for the l.d.c. subsector 4924, one thinks of a strategy of adjusting SIC 492 data and focusing it better on pipelines by removing the l.d.c. subsector, 4924. Unfortunately, most of the companies in Ibbotson's sample are in SIC 4924 (11 out of 12), and apparently only one is a mainly transmission company (1 out of 12). The one transmission company might or might not be representative. Because of that sample limitation, we do not try to remove SIC 4924 effects from the aggregate SIC 492. Instead, we report numbers for both sectors.

We purchased Ibbotson data for only the most recent period, namely, first quarter of 2003.

Attachment: Industry Group 492: *Gas Production And Distribution*

4922 Natural Gas Transmission

Establishments engaged in the transmission and/or storage of natural gas for sale.

- Natural gas storage
- Natural gas transmission
- Pipelines, natural gas

4923 Natural Gas Transmission and Distribution

Establishments engaged in both the transmission and distribution of natural gas for sale.

- Natural gas transmission and distribution

4924 Natural Gas Distribution

Establishments engaged in the distribution of natural gas for sale.

- Natural gas distribution

4925 Mixed, Manufactured, or Liquefied Petroleum Gas Production and/or

Establishments engaged in the manufacture and/or distribution of gas for sale, including mixtures of manufactured with natural gas.

To facilitate contrast, the tables following are number the same way as the corresponding tables in the API paper.

Capital structure

The debt share of total capital of the pipeline sector is shown in table 1.

Table 1. Debt share of capital (Median)

	SIC 492	SIC 4924
Jan-March 2003	45.40%	46.50%
5-year average	50.12%	50.03%

source: Ibbotson reports

Cost of debt

The cost of debt in these sectors varies by company. The Ibbotson data on bond rating are given in table 2. The sole non-l.d.c. company in the SIC 492 sample is apparently rated as BBB.

Table 2. Debt rating

S&P Debt rating	SIC 492 capital \$ billion	SIC 492 number of companies	SIC 4924 capital \$ billion	SIC 4924 number of companies
AAA,AA,A	\$10.5	6	\$10.5	6
BBB	\$13.7	4	\$4.4	3
BB,B,CCC,CC,D	0	0	0	0
Not rated	\$1.4	2	\$1.4	2

source: Ibbotson reports

One can infer from this table that the transmission company has a cost of debt that is BBB, and the l.d.c. companies are BBB or better. Looking at the row for BBB, SIC 492 covers 4 companies, whereas SIC 4924 covers 3 companies; thus the sole non-l.d.c. company apparently is BBB rated. This is consistent with the EIA statement that pipelines generally are rated BBB (cited above).

Marginal tax rates

Ibbotson sells marginal federal tax rate estimates for individual companies, not SIC aggregates. We have not tried to purchase data from Ibbotson regarding marginal tax rates for companies in SIC 492 or SIC 4924. Where it is necessary to apply an effective tax rate, we use a range of 15% to 35%.

Table 3. Marginal tax rate, assumed high-low range

High ... 35%

Low ... 15%

Cost of equity

There are several ways to define and to compute cost of equity capital, as explained in the Ibbotson literature. The API paper adopts the capital asset pricing model (CAPM) approach. This is as good as any for the present purpose, and we follow suit. There are two variants of this approach; the “size premium” adjustment accounts for the tendency for small companies to grow faster than textbook CAPM calculations allow for. See table 4 and footnote 1.

Table 4. Cost of equity capital (Median)

	SIC 492	SIC 4924
CAPM	5.56%	5.35%
CAPM + size premium	6.70%	6.75%

source: Ibbotson reports covering Jan-Mar 2003.

Weighted average cost of capital

Ibbotson combines cost of debt and cost of equity using its own tax adjustment to arrive at a consistent after-tax number. See table 5.

Table 5. After-tax WACC (median)

	SIC 492	SIC 4924
CAPM	6.67%	6.56%
CAPM + size premium	7.09%	7.14%

source: Ibbotson reports covering Jan-Mar 2003

Since the differences between the two columns are due to the presence of the sole non-l.d.c. company in SIC 492, one can infer something about that company’s WACC. According to the basic CAPM estimate, the larger aggregate SIC 492 has a WACC of 6.67%, which is slightly higher than the estimate for the l.d.c. subsector, namely, 6.56%. The implication is that the WACC for the sole non-l.d.c. company is pulling up the sector average, and indeed it must be greater than 6.67%. On the other hand, the CAPM + size premium estimate gives the aggregate SIC 492 WACC as 7.09%, which is lower than the estimate for the l.d.c. subsector of 7.14%. So, as regards the CAPM + size premium estimates, the sole non-l.d.c. company must be pulling the sector average down, and it must be lower than 7.09%. Being bracketed between 6.67% and 7.09%, the non-l.d.c. firm appears to have a WACC about 7%.

Pre-tax adjusted WACC

Pre-tax adjusted WACC can be computed assuming the range of tax rates 15%-30%. The purpose of the tax adjustment is to allow consistent comparison of WACC and the BBB rate. Whereas Ibbotson reports WACC on after-tax basis, the BBB rate is naturally a pre-tax number.

It doesn't matter whether one adjusts the WACC to make it pre-tax or one adjusts the bond rate to make it post-tax, so long as both terms are put on the same basis. In table 6, the adjustment is performed on the WACC. Specifically, the WACC numbers are divided by $1-t$. (To the extent that a greater proportion of costs can be expensed or depreciated more rapidly, the adjusted used overstates the resulting pre-tax rate of return.)

Table 6. Pre-tax WACC

	SIC 492, 15% tax rate case	SIC 492, 35% tax rate case	SIC 4924, 15% tax rate case	SIC 4924, 35% tax rate case
tax rate	0.15	0.35	0.15	0.35
After-tax WACC				
capm	6.67%	6.67%	6.56%	6.56%
capm +	7.09%	7.09%	7.14%	7.14%
Pre-tax adjusted WACC				
capm	7.85%	10.26%	7.72%	10.09%
capm +	8.34%	10.91%	8.40%	10.98%

source: tables 3 and 5

Observe that a sector's pre-tax adjusted WACC is greater as the tax rate is greater. Mathematically, a larger tax rate in the divisor, $1-t$, means dividing by a smaller number. Intuitively, as the tax rate is greater, the pre-tax WACC must be greater to generate the same net return in the face of taxes.

Earlier, in discussion of table 5, it was inferred that the WACC for the sole non-l.d.c. company in the Ibbotson sample must be about 7%. The conversion to a pre-tax basis can be performed on this number, too. It appears that the non-l.d.c. company's pre-tax adjusted WACC ranges from 8.2% to 10.8%.

Implied multiple of the BBB rate

The BBB bond rate for 1st quarter 2003 is shown in table 7a.

Table 7a. BBB industrial rate

Jan 2003	7.19%
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Feb 2003	7.09%
March 2003	7.12%
Average	7.13%

source: *Standard & Poors Bond Guide* per MMS staff

The ratio of (per-tax adjusted) WACC to the BBB rate is calculated for high and low effective tax rate assumptions and shown in table 7b, next.

Table 7b. Ratio of WACC to BBB, for low and high tax rates

	SIC 492, 15% tax rate case	SIC 492, 35% tax rate case	SIC 4924, 15% tax rate case	SIC 4924, 35% tax rate case
BBB	7.13%	7.13%	7.13%	7.13%
Pre-tax adjusted WACC				
capm	7.85%	10.26%	7.72%	10.09%
capm +	8.34%	10.91%	8.40%	10.98%
Ratio WACC/BBB				
capm	1.10	1.44	1.08	1.42
capm +	1.17	1.53	1.18	1.54

source: tables 6 and 7a

Again, one can infer something about the sole non-l.d.c. firm in the Ibbotson sample. It was observed earlier, in connection with table 6, that non-l.d.c. company's pre-tax adjusted WACC ranges from 8.2% to 10.8%. The implication is that the ratio of WACC/BBB for this company ranges from about 1.1 to 1.5. To provide a most likely ratio using this data set, we observe that several studies have concluded that the industry marginal tax rates are in the range of 20%. OMB requires use of a 25% marginal tax rate for the industry. Applying this rate to the after-tax WACC, and recalculating the ratio, we find the most likely multiplier to be 1.3.