B R I E F   C A S E S

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Midland Energy Resources, Inc.: Cost of Capital

In late January 2007, Janet Mortensen, senior vice president of project finance for Midland Energy Resources, was preparing her annual cost of capital estimates for Midland and each of its three divisions. Midland was a global energy company with operations in oil and gas exploration and production (E&P), refining and marketing (R&M), and petrochemicals. On a consolidated basis, the firm had 2006 operating revenue and operating income of $248.5 billion and $42.2 billion, respectively.

Estimates of the cost of capital were used in many analyses within Midland, including asset appraisals for both capital budgeting and financial accounting, performance assessments, M&A proposals, and stock repurchase decisions. Some of these analyses were performed at the division or business unit level, while others were executed at the corporate level. Midland's corporate treasury staff had begun preparing annual cost of capital estimates for the corporation and each division in the early 1980s. The estimates produced by treasury were often criticized, and Midland's division presidents and controllers sometimes challenged specific assumptions and inputs.

In 2002, Mortensen, then a senior analyst reporting to the CFO, was asked to estimate Midland's cost of capital in connection with a large proposed share repurchase. Six months later she was asked to calculate corporate and divisional costs of capital that the executive and compensation committees of the board could incorporate in planned performance evaluations. Since then, Mortensen had undertaken a similar exercise each year and her estimates had become widely circulated de facto standards in many analyses throughout the company, even ones in which they were not formally required. By 2007 Mortensen was aware that her calculations had become influential and she devoted ever more time and care to their preparation. Lately she wondered whether they were actually appropriate for all applications and she was considering appending a sort of "user's guide" to the 2007 set of calculations.

Midland's Operations

Midland Energy Resources had been incorporated more than 120 years previously and in 2007 had more than 80,000 employees. **Exhibits 1** and **2** present Midland's most recent consolidated financial statements. **Exhibit 3** presents selected business segment data for the period 2004-06.

Exploration & Production

Midland engaged in all phases of exploration, development, and production, though the last of these, production, dominated the E&P division's reported operating results. During 2006, Midland extracted approximately 2.10 million barrels of oil per day—a 6.3% increase over 2005 production—and roughly 7.28 billion cubic feet of natural gas per day—an increase of slightly less than 1% over 2005. This represented $22.4 billion of revenue and after-tax earnings of $12.6 billion. E&P was Midland's most profitable business, and its net margin over the previous five years was among the highest in the industry.

Midland expected continued global population and economic growth to result in rising demand for its products for the foreseeable future. Nevertheless, the fraction of production coming from non-traditional sources such as deepwater drilling, heavy oil recovery, liquefied natural gas (LNG), and arctic technology was expected to increase. Further, the geographic composition of output was shifting, marked by increases from places such as the Middle East, Central Asia, Russia, and West Africa.

With oil prices at historic highs in early 2007, Midland anticipated continued heavy investment in acquisitions of promising properties, in development of its proved undeveloped reserves, and in expanding production. In particular, continued high prices underlay plans to boost investment in sophisticated extraction methods that extended the lives of older fields and marginal properties. Capital spending in E&P was expected to exceed $8 billion in 2007 and 2008.

Refining and Marketing

Midland had ownership interests in 40 refineries around the world with distillation capacity of 5.0 million barrels a day. Measured by revenue, Midland's refining and marketing business was the company's largest. Global revenue for 2006 was $203.0 billion—a slight decrease of approximately 1.8% over 2005. The division faced stiff competition, as its products were highly commoditized. After-tax earnings for refining and marketing totaled only $4.0 billion. The relatively small margin was consistent with a long-term trend in the industry; margins had declined steadily over the previous 20 years.

Though most of Midland's refinery output was gasoline and was sold as fuel for automobiles, the company also had manufacturing capacity to produce approximately 120,000 barrels of base-stock lubricants per day. Midland believed its capacity was as technologically advanced as any in the industry. Advanced technology and vertical integration combined to make Midland a market leader in this business.

Midland projected capital spending in refining and marketing would remain stable, without substantial growth in 2007-08. This reflected both the historical trends of low and shrinking margins and the difficulty of obtaining the myriad approvals necessary to expand or to build and operate a new refinery. However, most analysts projected a longer-term global shortage of refining capacity that would eventually spur investment in this segment.

Petrochemicals

Petrochemicals was Midland's smallest division, but was a substantial business nonetheless. Midland owned outright or had equity interests in 25 manufacturing facilities and five research centers in eight countries around the world. The company's chemical products included polyethylene, polypropylene, styrene and polystyrene as well as olefins, 1-hexene, aromatics, and fuel and lubricant additives. In 2006, revenue and after-tax earnings were $23.2 billion and $2.1 billion, respectively.

Capital spending in petrochemicals was expected to grow in the near-term as several older facilities were sold or retired and replaced by newer, more efficient capacity. Much of the new investment would be undertaken by joint ventures outside the United States in which Midland's Petrochemicals Division owned a substantial minority interest.

Midland's Financial and Investment Policies

Midland's financial strategy in 2007 was founded on four pillars: (1) to fund significant overseas growth; (2) to invest in value-creating projects across all divisions; (3) to optimize its capital structure; and (4) to opportunistically repurchase undervalued shares.

Overseas Growth

The most easily exploited domestic resources had been put into production decades previously. Consequently, overseas investments were the main engine of growth for most large U.S. producers, and Midland was no exception. Midland usually invested in foreign projects alongside either a foreign government or a local business as partner. Often, these investments had specialized financial and contractual arrangements similar in many respects to project financing. In most cases, Midland acted as the lead developer of the project, for which it collected a management fee or royalty. Midland and its foreign partner shared the equity interest, with the foreign partner generally receiving at least 50% plus a preferred return. Despite the fact that the investments were located abroad, Midland analyzed and evaluated them in U.S. dollars by converting foreign currency cash flows to dollars and applying U.S. dollar discount rates. In 2006, Midland had earnings from equity affiliates of approximately $4.75 billion. The majority of these earnings, 77.7%, came from non-US investments.

Value-creating Investments

Midland used discounted cash flow methodologies to evaluate most prospective investments. Midland's DCF methods typically involved debt-free cash flows and a hurdle rate equal to or derived from the WACC for the project or division. However, Midland's interests in some overseas projects were instead analyzed as streams of future equity cash flows and discounted at a rate based on the cost of equity.

The performance of a business or division over a given historical period was measured in two main ways. The first was performance against plan over 1- , 3- , and 5-year periods. The second was based on "economic value added" (EVA), in which debt-free cash flows[1] were reduced by a capital

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[1] For purposes of EVA calculations, the company defined debt-free cash flows as net operating profit after taxes (NOPAT), which is EBIT(1-t).

charge, and expressed in dollars.[2] The capital charge was computed as the WACC for the business or division times the amount of capital it employed during the period.

Optimal Capital Structure

Midland optimized its capital structure in large part by prudently exploiting the borrowing capacity inherent in its energy reserves and in long-lived productive assets such as refining facilities. Debt levels were regularly reevaluated and long-term targets set accordingly. In particular, changes in energy price levels were correlated with changes in Midland's stock price, and necessitated regular reassessments of optimal borrowing. In 2007 both oil prices and Midland's stock price were at historic highs, which—all else equal—increased the company's borrowing capacity. This in turn represented an opportunity to shield additional profits from taxes.

Each of Midland's divisions had its own target debt ratio. Targets were set based on considerations involving each division's annual operating cash flow and the collateral value of its identifiable assets. Targets themselves tended to be "sticky," but changes in the market value of specific collateral, such as oil reserves, or the market capitalization of the company as a whole could drive actual debt ratios away from corresponding targets.

Mortensen's team did not set targets—they were set in consultations among division and corporate executives and the board—but Mortensen did estimate a debt rating for each division based on its target, and a corresponding spread over treasury bonds to estimate divisional and corporate costs of debt.[3] Mortensen's preliminary estimates for 2007 are shown below in **Table 1**.

Table 1

Business Segment:	Credit Rating	Debt/ Value	Spread to Treasury
Consolidated	A+	42.2%	1.62%
Exploration & Production	A+	46.0%	1.60%
Refining & Marketing	BBB	31.0%	1.80%
Petrochemicals	AA-	40.0%	1.35%

Note: Debt/Value is based on market values.

At December 31, 2006, the company's debt was rated A+ by Standard & Poor's. **Table 2** gives yields to maturity for U.S. Treasury bonds in January 2007.

Table 2

Maturity:	Rate:
1-Year	4.54%
10-Year	4.66%
30-Year	4.98%

Finally, although prudent use of Midland's debt capacity was a primary determinant of capital structure, other considerations played important roles as well. In particular, the strength of

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[2]The basic EVA equation employed by Midland was EVA = NOPAT – (r_{wacc})(Invested Capital).

[3] The spread to Treasury refers to the amount the borrower will have to pay in interest cost above U.S. Treasury securities of a similar maturity.

Midland's consolidated balance sheet and its access to global financial and commodity markets sometimes presented attractive opportunities to trade securities and commodities. Midland was conservative compared to some of its large competitors, but it did have a group of traders in-house who actively managed currency, interest rate, and commodity risks within a set of guidelines approved by the board. The desire to manage certain risks, or to take advantage of private information or unusual pricing relationships, was an additional reason that the actual capital structure sometimes departed, temporarily, from planned targets.

Stock Repurchases

In the past, Midland had repurchased its own shares on occasion, and had stated that it would do so again whenever attractive opportunities arose. Consequently, the company regularly estimated the intrinsic value of its shares by subtracting the market value of its debt from the fundamental value of the enterprise and dividing the result by the number of shares outstanding. The fundamental value of the consolidated enterprise was estimated using DCF analyses and a comparison of the company's trading multiples with those of its peers. When the stock price fell below the stock's intrinsic value, Midland considered repurchasing its shares. Small numbers of shares could be purchased on the open market; larger blocks would be bought via self-tenders.

Midland had not repurchased shares in large numbers since 2002 and no large purchases were anticipated by analysts in the near future, given the company's high stock price. Nevertheless, Midland executives pointed out that the mere fact that the stock price had risen did not mean the shares were not undervalued – intrinsic value had clearly risen as well, and Midland remained committed to repurchasing shares when they were undervalued. **Exhibit 4** shows Midland's historical stock prices, dividends per share, and selected financial data for the period 2001-06.

Estimating the Cost of Capital

Mortensen's primary calculations were based on the formula for WACC shown below.

In this expression, D and E are the market values of the debt and equity respectively, and V is the firm's or division's enterprise value (V = D + E). Similarly, r_d and r_e are the costs of debt and equity, respectively, and t is the tax rate.

$$WACC = r_d \left(\frac{D}{V} \right)(1-t) + r_e \left(\frac{E}{V} \right)$$

Cost of Debt

Mortensen computed the cost of debt for each division by adding a premium, or spread, over U.S. Treasury securities of a similar maturity. The spread depended on a variety of factors, including the division's cash flow from operations, the collateral value of the division's assets, and overall credit market conditions. For some of Midland's operations, long-term expected cash flow and collateral value were affected by political risk. This risk was most apparent, for example, in the exploration and production division. A significant fraction of E&P's productive assets and proven reserves were located in politically volatile countries in which the risk of nationalization or a forced renegotiation of production rights was significant. All else equal, such properties supported less borrowing than might otherwise be expected.

Cost of Equity

To estimate the cost of equity, Mortensen used the Capital Asset Pricing Model (CAPM), shown below, in which r_f denotes the risk-free rate of return, β is a measure of systematic risk, and EMRP denotes the equity market risk premium, that is, the amount by which the return on a broadly diversified portfolio of risky assets is expected to exceed the risk-free return over a specific holding period.

$$r_e = r_f + \beta(\text{EMRP})$$

Mortensen was aware that betas were measured, with error, from regressions of individual stock returns on market returns. She and her team used betas published in commercially available databases, rather than running their own regressions. Midland's beta was 1.25, for example. However, betas for Midland's divisions were not observable, since the divisions did not have traded shares of stock. To estimate betas for the divisions, Mortensen relied on published betas for publicly traded companies she deemed comparable to each division's business. A selection of these, along with related financial data, is presented in **Exhibit 5**.

In 2006 Midland used an equity market risk premium of 5.0%, but higher EMRPs—6.0% to 6.5%—had been used by Midland at various times in the past. Historical data on stock returns and bond yields, such as those presented in **Exhibit 6,** supported the higher estimates of the EMRP. Other data, such as the survey results shown in **Exhibit 6,** suggested lower figures. Midland adopted its current estimate of 5.0% after a review of recent research and in consultation with its professional advisors—primarily its bankers and auditors—as well as Wall Street analysts covering the industry.

Exhibit 1   Midland Income Statements, Years ended December 31 ($ in millions)

Operating Results:	2004	2005	2006
Operating Revenues	201,425	249,246	248,518
Plus: Other Income	1,239	2,817	3,524
Total Revenue & Other Income	202,664	252,062	252,042
Less: Crude Oil & Product Purchases	94,672	125,949	124,131
Less: Production & Manufacturing	15,793	18,237	20,079
Less: Selling, General & Administrative	9,417	9,793	9,706
Less: Depreciation & Depletion	6,642	6,972	7,763
Less: Exploration Expense	747	656	803
Less: Sales-Based Taxes	18,539	20,905	20,659
Less: Other Taxes & Duties	27,849	28,257	26,658
Operating Income	29,005	41,294	42,243
Less: Interest Expense	10,568	8,028	11,081
Less: Other Non-Operating Expenses	528	543	715
Income Before Taxes	17,910	32,723	30,447
Less: Taxes	7,414	12,830	11,747
Net Income	10,496	19,893	18,701

Exhibit 2   Midland Balance Sheets, at December 31 ($ in millions)

Assets:	**2005**	**2006**
Cash & Cash equivalents	16,707	19,206
Restricted Cash	3,131	3,131
Notes Receivable	18,689	19,681
Inventory	6,338	7,286
Prepaid Expenses	2,218	2,226
Total Current Assets	**47,083**	**51,528**
Investments & Advances	30,140	34,205
Net Property, Plant & Equipment	156,630	167,350
Other Assets	10,818	9,294
Total Assets	**244,671**	**262,378**
Liabilities & Owners' Equity:		
Accounts Payable & Accrued Liabilities	24,562	26,576
Current Portion of Long-Term Debt	26,534	20,767
Taxes Payable	5,723	5,462
Total Current Liabilities	**56,819**	**52,805**
Long-Term Debt	82,414	81,078
Post Retirement Benefit Obligations	6,950	9,473
Accrued Liabilities	4,375	4,839
Deferred Taxes	14,197	14,179
Other Long-Term Liabilities	2,423	2,725
Total Shareholders' Equity	77,493	97,280
Total Liabilities & Owners' Equity	**244,671**	**262,378**

Exhibit 3 Midland Segment Data ($ in millions)

Exploration & Production:	2004	2005	2006
Operating Revenue	15,931	20,870	22,357
After-Tax Earnings	6,781	13,349	12,556
Capital Expenditures	6,000	7,180	7,940
Depreciation	4,444	4,790	5,525
Total Assets	76,866	125,042	140,100

Refining & Marketing:	2004	2005	2006
Operating Revenue	166,280	206,719	202,971
After-Tax Earnings	2,320	4,382	4,047
Capital Expenditures	1,455	1,550	1,683
Depreciation	1,620	1,591	1,596
Total Assets	60,688	91,629	93,829

Petrochemicals:	2004	2005	2006
Operating Revenue	19,215	21,657	23,189
After-Tax Earnings	1,394	2,162	2,097
Capital Expenditures	305	330	436
Depreciation	578	591	642
Total Assets	19,943	28,000	28,450

Exhibit 4   Stock Prices, Dividends and Selected Financial Data

Stock Prices:	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Fourth Quarter	$27.16	$31.29	$32.59	$34.37	$38.32	$44.11
Third Quarter	$27.90	$30.41	$29.42	$35.78	$40.29	$39.75
Second Quarter	$28.33	$27.80	$32.45	$36.98	$37.52	$46.32
First Quarter	$24.13	$26.85	$31.57	$31.28	$34.58	$38.81
Dividends Per Share:						
Fourth Quarter	$0.28	$0.29	$0.30	$0.31	$0.34	$0.36
Third Quarter	$0.28	$0.29	$0.29	$0.31	$0.34	$0.36
Second Quarter	$0.28	$0.29	$0.29	$0.31	$0.34	$0.36
First Quarter	$0.28	$0.29	$0.29	$0.31	$0.34	$0.36
Annual Dividend	$1.11	$1.14	$1.17	$1.24	$1.35	$1.46
Selected Financial Data:						
Net income ($ in millions)	15,303	11,448	11,848	10,496	19,893	18,701
Shares Outstanding	2,049	2,025	2,035	2,055	2,945	2,951
EPS	7.47	5.65	5.82	5.11	6.75	6.34
Payout Ratio	14.8%	20.2%	19.9%	24.2%	20.0%	23.0%
DPS	1.11	1.14	1.16	1.24	1.35	1.46

Note: Results have not been adjusted for a divestiture at the end of 2001 and an acquisition at the beginning of 2005.

Exhibit 5 Comparable Company Information ($ in millions)

	Equity Market Value	Net Debt	D/E	Equity Beta	LTM Revenue	LTM Earnings
Exploration & Production:						
Jackson Energy, Inc.	57,931	6,480	11.2%	0.89	18,512	4,981
Wide Plain Petroleum	46,089	39,375	85.4%	1.21	17,827	8,495
Corsicana Energy Corp.	42,263	6,442	15.2%	1.11	14,505	4,467
Worthington Petroleum	27,591	13,098	47.5%	1.39	12,820	3,506
Average			**39.8%**	**1.15**		
Refining & Marketing:						
Bexar Energy, Inc.	60,356	6,200	10.3%	1.70	160,708	9,560
Kirk Corp.	15,567	3,017	19.4%	0.94	67,751	1,713
White Point Energy	9,204	1,925	20.9%	1.78	31,682	1,402
Petrarch Fuel Services	2,460	(296)	-12.0%	0.24	18,874	112
Arkana Petroleum Corp.	18,363	5,931	32.3%	1.25	49,117	3,353
Beaumont Energy, Inc.	32,662	6,743	20.6%	1.04	59,989	1,467
Dameron Fuel Services	48,796	24,525	50.3%	1.42	58,750	4,646
Average			**20.3%**	**1.20**		
Midland Energy Resources	**134,114**	**79,508**	**59.3%**	**1.25**	**251,003**	**18,888**

Market values are based on 12/31/06 closing prices. The average stock price for MIDLAND during 2006 was $42.31, and the average shares outstanding were 2,951 million.

Exhibit 6   The Equity Market Risk Premium—Selected Data and Studies

A. Selected historical data on U.S. stock returns minus Treasury bond yields

Period	Average excess return US Equities – T-Bonds	Standard error
1987-2006	6.4%	3.7%
1967-2006	4.8%	2.6%
1926-2006	7.1%	2.2%
1900-2006	6.8%	1.9%
1872-2006	5.9%	1.6%
1798-2006	5.1%	1.2%

Source: Pratt & Grabowski, *Cost of Capital, Applications and Examples*, John Wiley & Sons, 2008. Data are extracted from Exhibit 9.1, p. 95.

B. Selected market risk premium survey results

Researcher	Survey Subjects	Dates	Respondents' Risk Premia
Welch[a]	500+ finance & economics professors	2001	Median: 3.6% Interquartile range: 2.6%-5.6%
Graham & Harvey[b]	~400 U. S. CFOs	Quarterly 2000-2006	Range: 2.5% - 4.7% Most recent survey (4Q2006): 3.3%
Greenwich Associates[c]	US pension fund managers	2006	Range: 2% - 4%

Notes:

[a.] Ivo Welch, "The Equity Premium Consensus Forecast Revisited," Cowles Foundation Discussion Paper No. 1325, September 2001.

[b.] John Graham & Campbell Harvey, "The Equity Risk Premium in 2006: Evidence from the Global CFO Outlook Survey," downloaded at http://www.duke.edu/~charvey.

[c.] Greenwich Associates, "Market Trends, Actuarial Assumptions, Funding, and Solvency Ratios," Fall 2006.