devoted ever more time and care to their preparation. Lately she wondered whether they were

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

billion,

actually appropriate for all applications and she was considering appending a sort of “user’s guide”

to the 2007 set of calculations.

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HBS Professor Timothy A. Luehrman and Illinois Institute of Technology Adjunct Finance Professor Joel L. Heilprin prepared this case

specifically for the Harvard Business School Brief Case Collection. Though inspired by real events, the case does not represent a specific

situation at an existing company, and any resemblance to actual persons or entities is unintended. Cases are developed solely as the basis for

class discussion and are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.

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divisions. Midland was a global energy company with operations in oil and gas exploration and



**4129**

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T I M O T H Y A . L U E H R M A N

J O E L L . H E I L P R I N

**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

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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

lubricants per day. Midland believed its capacity was as technologically advanced as any in the

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

sophisticated extraction methods that extended the lives of older fields and marginal properties.

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.

**2**

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Midland’s most profitable business, and its net margin over the previous five years was among the

**4129** | **Midland Energy Resources, Inc.: Cost of Capital**

**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

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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

The performance of a business or division over a given historical period was measured in two

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.

and Midland was no exception. Midland usually invested in foreign projects alongside either a

main ways. The first was performance against plan over 1- , 3- , and 5-year periods. The second was

1

were reduced by a capital

based on “economic value added” (EVA), in which debt-free cash flows

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).

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products

**Midland Energy Resources, Inc.: Cost of Capital** | **4129**

*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

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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,

**Table 2**

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.

AA-

*Maturity:*

Rate:

1-Year

4.54%

10-Year

A+

Consolidated

A+

42.2%

1.62%

Exploration & Production

4.66%

46.0%

1.60%

Refining & Marketing

BBB

31.0%

1.80%

Petrochemicals

wacc

strength

of

2

The basic EVA equation employed by Midland was EVA = NOPAT – (r

)(Invested Capital).

the

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.

**4**

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**Treasury**

particular,

In

well.

as

roles

important

played

considerations

other

structure,

Finally, although prudent use of Midland’s debt capacity was a primary determinant of capital

4.98%

30-Year

Targets

divisions

had

its

own

target

debt

ratio.

Midland’s

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.

of

Each

represented an opportunity to shield additional profits from taxes.

historic highs, which—all else equal—increased the company’s borrowing capacity. This in turn

reassessments of optimal borrowing. In 2007 both oil prices and Midland’s stock price were at

in energy price levels were correlated with changes in Midland’s stock price, and necessitated regular

Debt levels were regularly reevaluated and long-term targets set accordingly. In particular, changes

capacity inherent in its energy reserves and in long-lived productive assets such as refining facilities.

Midland optimized its capital structure in large part by prudently exploiting the borrowing

*Optimal Capital Structure*

division times the amount of capital it employed during the period.

The capital charge was computed as the WACC for the business or

charge, and expressed in dollars.

2

**4129** | **Midland Energy Resources, Inc.: Cost of Capital**

Mortensen’s preliminary estimates for 2007 are shown below in **Table 1**.

corporate costs of debt.

**Table 1**

3

**Credit**

**Debt/**

**Spread to**

*Business Segment:*

**Rating**

**Value**

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based on its target, and a corresponding spread over treasury bonds to estimate divisional and

corporate executives and the board—but Mortensen did estimate a debt rating for each division

and

division

among

consultations

in

set

were

targets—they

set

not

did

team

Mortensen’s

⎛

=

+

−

*r*

*t*

)

1

(

*r*

*WACC*

⎞

⎛

⎞

⎜

*E*

*D*

respectively, and t is the tax rate.

e

d

firm’s or division’s enterprise value (V = D + E). Similarly, r

are the costs of debt and equity,

and r

In this expression, D and E are the market values of the debt and equity respectively, and V is the

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

**Estimating the Cost of Capital**

historical stock prices, dividends per share, and selected financial data for the period 2001-06.

committed to repurchasing shares when they were undervalued. **Exhibit 4** shows Midland’s

Mortensen computed the cost of debt for each division by adding a premium, or spread, over U.S.

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**5**

**HARVARD BUSINESS SCHOOL | BRIEFCASES**

might otherwise be expected.

production rights was significant. All else equal, such properties supported less borrowing than

located in politically volatile countries in which the risk of nationalization or a forced renegotiation of

and production division. A significant fraction of E&P’s productive assets and proven reserves were

value were affected by political risk. This risk was most apparent, for example, in the exploration

market conditions. For some of Midland’s operations, long-term expected cash flow and collateral

division’s cash flow from operations, the collateral value of the division’s assets, and overall credit

Treasury securities of a similar maturity. The spread depended on a variety of factors, including the

shares were not undervalued – intrinsic value had clearly risen as well, and Midland remained

*Cost of Debt*

⎠

⎝

⎠

⎝

*V*

*V*

*e*

*d*

⎟

⎜

⎟

the

the

dividing

and

enterprise

the

of

value

the intrinsic value of its shares by subtracting the market value of its debt from the fundamental

so again whenever attractive opportunities arose. Consequently, the company regularly estimated

In the past, Midland had repurchased its own shares on occasion, and had stated that it would do

*Stock Repurchases*

structure sometimes departed, temporarily, from planned targets.

capital

actual

result

that

reason

additional

an

was

unusual pricing relationships,

information or

approved by the board. The desire to manage certain risks, or to take advantage of private

who actively managed currency, interest rate, and commodity risks within a set of guidelines

conservative compared to some of its large competitors, but it did have a group of traders in-house

sometimes presented attractive opportunities to trade securities and commodities. Midland was

Midland’s consolidated balance sheet and its access to global financial and commodity markets

**Midland Energy Resources, Inc.: Cost of Capital** | **4129**

enterprise

Midland executives pointed out that the mere fact that the stock price had risen did not mean the

anticipated by analysts in the near future, given the company’s high stock price. Nevertheless,

Midland had not repurchased shares in large numbers since 2002 and no large purchases were

shares could be purchased on the open market; larger blocks would be bought via self-tenders.

below the stock’s intrinsic value, Midland considered repurchasing its shares. Small numbers of

comparison of the company’s trading multiples with those of its peers. When the stock price fell

a

and

analyses

DCF

using

estimated

was

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consolidated

the

of

value

fundamental

The

outstanding.

shares

of

number

the

by

had been used by Midland at various times in the past. Historical data on stock returns and bond

f

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%—

e

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.

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**BRIEFCASES | HARVARD BUSINESS SCHOOL**

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diversified portfolio of risky assets is expected to exceed the risk-free return over a specific holding

**4129** | **Midland Energy Resources, Inc.: Cost of Capital**

*Cost of Equity*

To estimate the cost of equity, Mortensen used the Capital Asset Pricing Model (CAPM), shown

β

below, in which r

denotes the risk-free rate of return,

is a measure of systematic risk, and EMRP

f

denotes the equity market risk premium, that is, the amount by which the return on a broadly

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period.

β

= r

+

(EMRP)

r

543

528

Less: Other Non-Operating Expenses

11,081

8,028

10,568

Less: Interest Expense

**42,243**

**41,294**

**29,005**

**Operating Income**

715

26,658

28,257

27,849

Less: Other Taxes & Duties

20,659

20,905

18,539

Less: Sales-Based Taxes

803

656

747

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**7**

**HARVARD BUSINESS SCHOOL | BRIEFCASES**

**18,701**

**19,893**

**10,496**

**Net Income**

Less: Exploration Expense

11,747

12,830

7,414

Less: Taxes

**30,447**

**32,723**

**17,910**

**Income Before Taxes**

**2004**

1,239

Plus: Other Income

**248,518**

**249,246**

**201,425**

**Operating Revenues**

**2006**

**2005**

2,817

*Operating Results:*

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

**Exhibit 1**

**Midland Energy Resources, Inc.: Cost of Capital** | **4129**

124,131

7,763

6,972

6,642

Less: Depreciation & Depletion

9,706

9,793

9,417

Less: Selling, General & Administrative

20,079

18,237

15,793

Less: Production & Manufacturing

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125,949

94,672

Less: Crude Oil & Product Purchases

**252,042**

**252,062**

**202,664**

**Total Revenue & Other Income**

3,524

5,462

Post Retirement Benefit Obligations

81,078

82,414

Long-Term Debt

**52,805**

**56,819**

**Total Current Liabilities**

5,723

Taxes Payable

6,950

20,767

26,534

Current Portion of Long-Term Debt

26,576

24,562

Accounts Payable & Accrued Liabilities

*Liabilities & Owners' Equity:*

**262,378**

**244,671**

**Total Assets**

Total Shareholders' Equity

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**BRIEFCASES | HARVARD BUSINESS SCHOOL**

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**262,378**

**244,671**

**Total Liabilities & Owners' Equity**

77,493

97,280

2,725

2,423

Other Long-Term Liabilities

14,179

14,197

Deferred Taxes

4,839

4,375

Accrued Liabilities

9,473

**2005**

3,131

3,131

Restricted Cash

19,206

16,707

Cash & Cash equivalents

**2006**

Notes Receivable

*Assets:*

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

**Exhibit 2**

**4129** | **Midland Energy Resources, Inc.: Cost of Capital**

**47,083**

9,294

10,818

Other Assets

167,350

156,630

Net Property, Plant & Equipment

34,205

30,140

Investments & Advances

**51,528**

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**Total Current Assets**

2,218

Prepaid Expenses

2,226

7,286

6,338

Inventory

19,681

18,689

**2006**

**2005**

**2004**

*Petrochemicals:*

93,829

91,629

60,688

Total Assets

1,596

1,591

1,620

Depreciation

1,683

1,550

1,455

Capital Expenditures

4,047

4,382

591

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**HARVARD BUSINESS SCHOOL | BRIEFCASES**

28,450

28,000

19,943

Total Assets

642

2,320

578

Depreciation

436

330

305

Capital Expenditures

2,097

2,162

1,394

After-Tax Earnings

23,189

21,657

19,215

Operating Revenue

7,180

6,000

Capital Expenditures

12,556

13,349

6,781

After-Tax Earnings

22,357

20,870

15,931

Operating Revenue

7,940

**2006**

**2005**

**2004**

*Exploration & Production:*

Midland Segment Data ($ in millions)

**Exhibit 3**

**Midland Energy Resources, Inc.: Cost of Capital** | **4129**

After-Tax Earnings

202,971

206,719

166,280

Operating Revenue

**2006**

**2005**

**2004**

*Refining & Marketing:*

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140,100

125,042

76,866

Total Assets

5,525

4,790

4,444

Depreciation

Net income ($ in millions)

$1.11

$1.14

$1.17

$1.24

$1.35

$1.46

*Selected Financial Data:*

Annual Dividend

15,303

11,448

11,848

10,496

19,893

18,701

Shares Outstanding

2,049

$0.34

$0.31

$0.34

$0.36

First Quarter

$0.28

$0.29

$0.29

$0.31

2,025

$0.36

23.0%

DPS

1.11

1.14

1.16

1.24

1.35

1.46

20.0%

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

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**BRIEFCASES | HARVARD BUSINESS SCHOOL**

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5.11

2,035

2,055

2,945

2,951

EPS

7.47

5.65

5.82

$0.29

6.75

6.34

Payout Ratio

14.8%

20.2%

19.9%

24.2%

$34.37

Fourth Quarter

$27.16

$31.29

$32.59

**2006**

$38.32

$44.11

Third Quarter

$27.90

$30.41

$29.42

$35.78

$40.29

**4129** | **Midland Energy Resources, Inc.: Cost of Capital**

**Exhibit 4**

Stock Prices, Dividends and Selected Financial Data

$39.75

*Stock Prices:*

**2001**

**2002**

**2003**

**2004**

**2005**

$0.29

$0.28

$0.29

$0.30

$0.31

$0.34

$0.36

Third Quarter

$0.28

Fourth Quarter

$0.29

$0.31

$0.34

$0.36

Second Quarter

$0.28

$0.29

$24.13

Second Quarter

$28.33

$27.80

$32.45

$36.98

$37.52

$46.32

First Quarter

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$26.85

$31.57

$31.28

$34.58

$38.81

*Dividends Per Share:*

18,363

Petrarch Fuel Services

2,460

(296)

-12.0%

0.24

18,874

112

Arkana Petroleum Corp.

1,402

5,931

32.3%

1.25

49,117

3,353

Beaumont Energy, Inc.

32,662

6,743

31,682

1.78

20.9%

1,925

9,204

White Point Energy

1,713

67,751

0.94

19.4%

3,017

15,567

Kirk Corp.

9,560

160,708

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

**Midland Energy Resources**

**134,114**

**79,508**

**59.3%**

**1.25**

**251,003**

**18,888**

**1.20**

shares outstanding were 2,951 million.

**HARVARD BUSINESS SCHOOL | BRIEFCASES**

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1.70

**20.3%**

**Average**

4,646

58,750

1.42

50.3%

24,525

48,796

Dameron Fuel Services

1,467

59,989

1.04

20.6%

*Exploration & Production:*

**Market Value**

**Debt**

**D/E**

**Beta**

**Revenue**

**Earnings**

Jackson Energy, Inc.

57,931

6,480

11.2%

0.89

18,512

4,981

**LTM**

**LTM**

**Equity**

**Net**

**Equity**

Comparable Company Information ($ in millions)

**Exhibit 5**

**Midland Energy Resources, Inc.: Cost of Capital** | **4129**

**39.8%**

13,098

47.5%

1.39

12,820

3,506

**Average**

27,591

**1.15**

*Refining & Marketing:*

Bexar Energy, Inc.

60,356

6,200

10.3%

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Worthington Petroleum

4,467

14,505

1.11

15.2%

6,442

42,263

Corsicana Energy Corp.

8,495

17,827

1.21

85.4%

39,375

46,089

Wide Plain Petroleum

Welch

500+ finance & economics

2001

Median: 3.6%

professors

Interquartile range: 2.6%-5.6%

a

b

Graham & Harvey

~400 U. S. CFOs

**Respondents’ Risk Premia**

**Researcher**

**Survey Subjects**

**Dates**

Quarterly

downloaded at http://www.duke.edu/~charvey.

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,”

c.

Greenwich Associates, “Market Trends, Actuarial Assumptions, Funding, and Solvency Ratios,” Fall 2006.

**12**

**BRIEFCASES | HARVARD BUSINESS SCHOOL**

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Range: 2.5% - 4.7%

2000-2006

Most recent survey (4Q2006): 3.3%

c

Greenwich Associates

US pension fund managers

2006

Range: 2% - 4%

1987-2006

6.4%

3.7%

1967-2006

4.8%

2.6%

**4129** | **Midland Energy Resources, Inc.: Cost of Capital**

**Exhibit 6**

The Equity Market Risk Premium—Selected Data and Studies

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

1926-2006

**Average excess return**

**Period**

**US Equities – T-Bonds**

**Standard error**

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

1.9%

7.1%

2.2%

1900-2006

6.8%

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1872-2006

5.9%

1.6%