

Part 2

efficiency. Evidence that an arbitrageur could have systematically earned returns in excess of trading costs by exploiting serial correlation would be inconsistent with market efficiency.

69. I performed dozens of statistical tests for serial correlation in this case, and the results are reported in Exhibit 20. I find some evidence of statistical correlation of the returns and excess returns, especially for Royal Dutch New York Shares, over the 5-year Class Period. Although some of the tests indicate statistically significant serial correlation, the degree of correlation measured is economically negligible in that a market investor facing normal transaction costs would not be able to earn above-normal returns by trading on the basis of the serial correlation that I measure for Royal Dutch New York Shares or Shell Transport ADRs.⁵²

70. Moreover, it appears that much of the measured serial correlation is confined to one year (2000). Panel B repeats all of the 22 tests in Panel A using data that is identical except that data for 2000 is excluded. So, Panel B's tests use daily data from April 8, 1999 through December 31, 1999 and January 1, 2001 through March 18, 2004.

71. The results in Panel B show that most of the serial correlation is confined to 2000. The magnitude of the coefficients of the lagged variable and the adjusted R-squared are reduced across all of the tests, and only one of the coefficients is significant at the 5% level in Panel B. Therefore, based on this statistical study I conclude that the behavior of the returns and excess returns of Royal Dutch New York Shares and Shell Transport ADRs over the 5-year Class Period is consistent with semi-strong form of market efficiency. I find no evidence that market

⁵² The largest coefficient is -0.10, which implies that a day with an excess return of 1% would be expected to be followed by a day with -0.1% excess return, absent any other factor that would impact the stock price. The average excess return for Royal Dutch New York Shares over the Class Period is -0.05% which would imply that on average the next day would be expected to have an excess return of 0.005%. Based on an average stock price of \$53 for Royal Dutch New York Shares, this expected return of 0.005% translates to 24/100th of one cent.

investors could have earned returns above trading costs using any trading strategy based on the time-series behavior of past returns for the two stocks.

c) Correlation Analysis

72. I also performed an analysis of the correlation between the stock price returns. A high correlation implies that the stock price generally move in tandem and that there are minimal price mismatches that can be exploited through arbitrage. The results of my correlation analysis are discussed below.

73. The correlation coefficient for the returns on Royal Dutch New York Shares and the Shell Transport ADRs over the period April 8, 1999 through December 31, 2003 is 0.92. The correlation coefficient for the returns on Royal Dutch New York Shares and the Shell Transport ADRs over the period April 8, 1999 through December 31, 2001 is 0.91 and over the period 2002 through 2003 is 0.93. This analysis indicates that, as expected, the prices of Royal Dutch New York Shares and Shell Transport ADRs generally moved in tandem.

74. The correlation coefficient for the returns on Royal Dutch closing stock price on the Amsterdam/Euronext Exchange (in euros) and the Royal Dutch closing stock price on the Amsterdam Exchange converted to US dollars over the period April 8, 1999 through December 31, 2003 is 0.94.⁵³ The correlation coefficient for the returns on Royal Dutch closing stock price on the Amsterdam/Euronext Exchange (in euros) and the Royal Dutch closing stock price on the Amsterdam Exchange converted to US dollars over the period April 8, 1999 through December 31, 2001 is 0.93 and over the period 2002 through 2003 is 0.95.

⁵³ The closing stock prices for the foreign exchanges converted to US dollars were obtained from Bloomberg.

75. If the returns were literally identical, then the correlation would be perfect and the correlation coefficient would be 1. Although it is very close to 1, the correlation coefficient of less than 1 is most likely due to intraday fluctuations in foreign exchanges that are not captured when the price on the foreign exchange is converted to US dollars based on the foreign exchange at the end of the day.

76. The correlation coefficient for the returns on Shell Transport closing stock price on the LSE (in pounds) and the Shell Transport closing stock price on the LSE converted to US dollars over the period April 8, 1999 through December 31, 2003 is 0.97. The correlation coefficient for the returns on Shell Transport closing stock price on the LSE (in pounds) and the Shell Transport closing stock price on the LSE converted to US dollars over the periods April 8, 1999 through December 31, 2001 and 2002 through 2003 are also 0.97. Again, the correlation coefficient of less than 1 is most likely due to intraday fluctuations in foreign exchanges that are not captured when the price on the foreign exchange is converted to US dollars based on the foreign exchange at the end of the day.

77. The correlation coefficient for the returns on Royal Dutch closing stock price on the Amsterdam/Euronext Exchange (in euros) and the Royal Dutch intraday stock price (in USD) on the NYSE over the period April 8, 1999 through December 31, 2003 is 0.87. The correlation coefficient for the returns on Royal Dutch closing stock price on the Amsterdam/Euronext Exchange (in euros) and the Royal Dutch intraday stock price (in USD) on the NYSE over the period April 8, 1999 through December 31, 2001 is 0.84 and over the period 2002 through 2003 is 0.92.⁵⁴

⁵⁴ For the purpose of this analysis, I have attempted to obtain intraday prices on the NYSE for Royal Dutch New York Shares and Shell Transport ADRs to match the time at which

78. The correlation coefficient for the returns on Royal Dutch closing stock price on the Amsterdam/Euronext Exchange (converted to USD) and the Royal Dutch intraday stock price (in USD) on the NYSE over the period April 8, 1999 through December 31, 2003 is 0.89. The correlation coefficient for the returns on Royal Dutch closing stock price on the Amsterdam/Euronext Exchange (converted to USD) and the Royal Dutch intraday stock price (in USD) on the NYSE over the period April 8, 1999 through December 31, 2001 is 0.85 and over the period 2002 through 2003 is 0.95. This correlation analysis is most likely affected by any intraday movements in foreign exchange rate between USD and euros.

79. The correlation coefficient for the returns on Shell Transport closing stock price on the LSE (in pounds) and the Shell Transport intraday ADR price (in USD) on the NYSE over the period April 8, 1999 through December 31, 2003 is 0.87. The correlation coefficient for the returns on Shell Transport closing stock price on the LSE (in pounds) and the Shell Transport intraday ADR price (in USD) on the NYSE over the period April 8, 1999 through December 31, 2001 is 0.84 and over the period 2002 through 2003 is 0.93.

80. The correlation coefficient for the returns on Shell Transport closing stock price on the LSE (converted to USD) and the Shell Transport intraday ADR price (in USD) on the NYSE over the period April 8, 1999 through December 31, 2003 is 0.89. The correlation coefficient for the returns on Shell Transport closing stock price on the LSE (converted to USD) and the Shell Transport intraday ADR price (in USD) on the NYSE over the period April 8, 1999 through December 31, 2001 is 0.86 and over the period 2002 through 2003 is 0.94. This

trading closed on the Amsterdam/Euronext and London Stock Exchanges respectively. For details of the methodology, see Exhibit 20.

correlation analysis is most likely affected by any intraday movements in foreign exchange rate between USD and pounds.

81. In addition, in Exhibit 21, I present the average and median difference between the closing price on the foreign stock exchange (converted to USD) and intraday price on the NYSE (in USD) for Royal Dutch and Shell Transport. The average and median difference between the Royal Dutch closing stock price on the Amsterdam/Euronext stock exchange (converted to USD) and the Royal Dutch intraday stock price on the NYSE (in USD) over the period April 8, 1999 through December 31, 2003 was \$0.02. The average and median difference between the Shell Transport closing stock price on the LSE (converted to USD) and Shell Transport intraday ADR price on the NYSE (in USD) over the period April 8, 1999 through December 31, 2003 was -\$0.12 and -\$0.07 respectively. This analysis shows that the magnitude of price difference between the foreign stock exchange and the NYSE was not large enough to provide arbitrage opportunities after accounting for transaction costs.

82. Based on the analysis provided in this section VII.A, I conclude that the trading in Royal Dutch stock on the Amsterdam/Euronext Exchange and NYSE, the trading in Shell Transport stock on the LSE and the trading in Shell Transport ADRs on the NYSE was conducted in informationally efficient markets.

B. MATERIALITY AND LOSS CAUSATION

i. Plaintiffs' Allegations of Misrepresentations and Omissions

83. During the Class Period, Plaintiffs allege that the Defendants made false and misleading statements regarding Royal Dutch/Shell's proved oil and gas reserves. Plaintiffs allege that the inflated proved oil and gas reserves, financial results and financial position caused

the market to exaggerate its expectations of Royal Dutch/Shell's financial position and future financial results, which were then reflected in inflated stock prices throughout the Class Period.

84. Specifically, the Complaint alleges that Royal Dutch/Shell reported, in SEC filings and other public statements and documents, certain reserves as "proved" from projects around the world, including, but not limited to, a project off the western coast of Australia called the Gorgon Joint Venture, and various projects in Nigeria. In fact, Royal Dutch/Shell later disclosed that the booked reserves did not meet the requirements for booking reserves as proved. In the Companies' Form 20-F/A for 2002, dated July 2, 2004, the Companies stated that 4.47 billion boe, representing 23% of the Companies' proved reserves as of December 31, 2002, would be removed from the proved reserve category. Plaintiffs allege that the reserves were improperly reported as proved reserves in Royal Dutch/Shell's public statements and financial reports, thereby materially artificially inflating a key measure of the Companies' financial position and competitive standing.

ii. Disclosures Removing the Artificial Inflation Caused by the Misrepresentations and Omissions Concerning the Overstated Proved Reserves

85. Beginning on January 9, 2004, Royal Dutch/Shell made several disclosures that provided the market with information that corrected the alleged misrepresentations or information about the consequences of the alleged misrepresentations. I discuss each of these disclosures below.

a) January 9, 2004

86. On January 9, 2004, before the open of markets in the US and Europe, Royal Dutch/Shell announced that 3.9 billion barrels of oil equivalent ("boe") of proved hydrocarbon reserves were being recategorized as of December 31, 2002, which represented 20% of the

proved reserves as of that date. The total reduction in the proved undeveloped category was over 90% and the remaining reduction was in the proved developed category. The FAS69 standardized measure of cashflows associated with the proved reserves was estimated to be reduced by 10%, significantly less than the 20% reduction in the proved reserves because the majority of the recategorization related to proved undeveloped reserves and to relatively low margin producing areas. The reserves affected had been mainly booked in the period 1996 to 2002.⁵⁵

87. In addition, the Companies disclosed that the reserve replacement ratio for 2003 was expected to be in the range of 70-90%, representing the net addition of between 1.0 and 1.3 billion boe. The Companies planned to disclose the final figures for 2003 reserve replacement on February 5, 2004.⁵⁶

88. The Companies also disclosed that there was no material effect on financial statements for any year up to and including 2003. The Companies stated that the recategorization of proved reserves did not materially change either the estimated total volume of hydrocarbons in place or the volumes that were ultimately expected to be recovered. The Companies anticipated that most of these reserves would be re-booked in the proved category over time as the field developments matured.⁵⁷

89. This disclosure resulted in significant stock price declines for Royal Dutch and Shell Transport equity securities. See Exhibit 7. The Royal Dutch New York Shares declined

⁵⁵ "SHELL TRANSPORT & TRADING CO PLC: Proved reserve recategorisation after internal review," PR Newswire, January 9, 2004, 2:01 AM.

⁵⁶ "SHELL," TRANSPORT & TRADING CO PLC: Proved reserve recategorisation after internal review, PR Newswire, January 9, 2004, 2:01 AM.

⁵⁷ "SHELL," TRANSPORT & TRADING CO PLC: Proved reserve recategorisation after internal review, PR Newswire, January 9, 2004, 2:01 AM.

7.87% or \$4.15 from the previous day's closing price of \$52.76, to close at \$48.61. The reported trading volume for the Royal Dutch New York Shares approximately 21 million shares, which was more than eight times the average reported volume over 2003 of 2.4 million shares. The excess return for the Royal Dutch New York Shares of -7.72% was statistically significant. The excess price decline was \$4.08 (calculated as $-7.72\% \times \$52.76$).

90. The Royal Dutch Amsterdam Shares declined 7.65% or 3.17 euros from the previous day's closing price of 41.43 euros, to close at 38.26 euros. The reported trading volume was more than 53 millions shares. The excess return for the Royal Dutch Amsterdam Shares of -7.32% was statistically significant.

91. The Shell Transport ADRs declined 6.96% or \$3.12 from the previous day's closing price of \$44.81, to close at \$41.69. The reported trading volume for the Shell Transport ADRs was approximately 2 million ADRs, which was more than five times the average reported volume over 2003 of approximately 345,000 ADRs. The excess return for the Shell Transport ADRs of -6.89% was statistically significant. The excess price decline was \$3.09 (calculated as $-6.89\% \times \$44.81$).

92. The Shell Transport London Shares declined 7.48% or 30 pence from the previous day's close of 401.25 pence, to close at 371.25 pence. The reported trading volume for the Shell Transport London Shares was more than 236 million shares. The excess return of -7.11% was statistically significant.

93. Several news stories attributed the stock price decline in Royal Dutch and Shell Transport equity securities to the reserve recategorization:

Shell (SHEL.L)/Royal Dutch (RD.AS) fell seven percent after the oil giant said that 20 percent of its proved hydrocarbon reserves

will be recategorised. That prompted expectations of a drop in cash flow and broker downgrades.

"We are seeing aggressive selling of Royal Dutch on the back of this news. Twenty percent of reserves is a lot to recategorise with no reason," said one pan-European trader.⁵⁸

A sharp fall by Anglo-Dutch oil giant Shell (SHEL.L) (RD.AS) after it cut its proven oil and gas reserve base dragged Britain's top shares lower on Friday.

Shell's London-listed shares tumbled six percent to 377 pence after it cut its proven reserves by 20 percent, which analysts said raised concern about the group's long-term growth prospects. Merrill Lynch downgraded its rating to Shell to "neutral" from "buy". John Smith, chief investment office at Solus Fund Managers, said the stock was hit by the shock and uncertainty about its prospects.

"Clearly the longer term growth prospects raise some concerns. Where is the long-term growth going to come from if their proven reserves are far less, or are they being ultra-cautious and will a lot of those reserves potentially come back?" Smith said.⁵⁹

94. In addition, various analysts shared their analysis and comments of the disclosure as indicated by the following selected excerpts:

The Royal Dutch/Shell Group announced a negative reserve revision equating to 20% of its total proved reserve base, or 3.9 billion barrels of oil equivalent early this morning. In addition, the company said that reserve replacement in 2003 is projected in the 70%-90% range (90%-110% excluding purchases and sales). In our opinion, these announcements have significant negative implications on several fronts. First, **large negative reserve revisions by major oil companies for reasons other than a steep drop in oil or gas prices are highly unusual.** Major oils, especially those in the supermajor category, are thought to be the most conservative within the industry in booking reserves. Typically, oil and gas reserves are not recorded as proven until the discovered resources have been sanctioned for development. We had understood this to be the case for Royal Dutch/Shell but,

⁵⁸ "European stock flat, but Royal Dutch/Shell a worry," Reuters News, January 9, 2004, 3:36 AM.

⁵⁹ "Shell hit by growth worry as oils drag FTSE lower." Reuters News, January 9, 2004, 5:43 AM.

apparently, we were misled. We cannot recall a revision of this magnitude by a major oil company. Second, **2003 will mark the third consecutive year of disappointing reserve replacement for RD/SC.** Third, the surprise announcement was made formally to shareholders in Europe. The press release was issued at 2:00 am EST and the conference call occurred at 4:00 am EST. U.S. shareholders were literally left in the dark. In our judgment, this is likely to compound the company's credibility problems and could result in dead- money performance of its shares for some time to come. **We have downgraded our recommendation on Royal Dutch Petroleum and Shell Transport and Trading to Underperform from Peer Perform.** ("The Royal Dutch/Shell Group - Underperform: Significant Negative Reserve Revision; Recommendation Downgraded to Underperform," Bear Stearns, January 9, 2004, pp. 1-2.)

This morning Royal Dutch/Shell Group announced a sizable 20% writedown in its proved oil and gas reserves. This announcement has negative implications for the stock, and we are downgrading our recommendation, from Sector Outperformer, to Sector Underperformer, and revising our price target, from \$52.00 per share, to \$45.00. ("Royal Dutch Petroleum: Downgrading Stock On Revision To Proved Reserves," CIBC World Markets, January 9, 2004, p. 2.)

Shell Group reports that it is eliminating 3.9 billion Boe's of proven reserves from its books, which represents 20% of the total. Approximately 90% of the change relates to proved undeveloped reserves and 10% relate to proved developed. Projects where reserves have been reclassified include the Gorgon natural gas project in Australia, and fields in Nigeria. Crude oil and NGL's represent 2/3 of the re-classification of reserves while natural gas accounts for the remaining 1/3. ("Royal Dutch Petroleum: Downgrading Stock On Revision To Proved Reserves," CIBC World Markets, January 9, 2004, p. 2.)

RD/Shell announced on Friday 9th January that a detailed internal review had led to a 20% downgrade to its proved reserve base. The scale of this downgrade is unprecedented in the industry and has led to a sharp sell-off, unsurprisingly, by the market. ("Royal Dutch Petroleum: The disappearing act," Credit Lyonnais Securities, January 9, 2004, p. 1.)

The announcement also has clear implications for production growth at RD/Shell, although the group expects only flat production growth until 2005. Even this modest target must now be at risk. We will have to wait until 5th February to get more details on the effect on production growth but at this stage it is clear that it will have a materially negative impact. ("Royal Dutch Petroleum: The disappearing act," Credit Lyonnais Securities, January 9, 2004, p. 1.)

Investment Conclusion – Reducing Target Prices, Management Credibility Impaired

We are reducing our target prices for RD and SC by about 6-7%, to \$47 for RD and \$40 for SC. This reduction arises from two distinct and roughly equal factors. First, the net present value of its proved reserves (as measured under SEC guidelines) is expected to initially decline by about 10%, but presumably recover in future years as and if the downgraded reserves are rebooked as proved. Since total proved reserves account for about 50%-60% of our normalized valuation of the company, this factor reduces our target price by about 3%. Second, management's credibility will likely suffer, and this is expected to reduce investor confidence and thus the price paid for future earnings and cash flow. ("RD: ROYAL DUTCH 'RECATEGORIZES' HYDROCARBON RESERVES AND REDUCES PROVED RESERVES BY 20%. DOWNGRADED TO NEUTRAL WEIGHT THIS MORNING - REDUCING TARGET PRICE TO \$47," Prudential Financial, January 9, 2004, p. 2.)

We are stunned and disappointed by the announcement made by Shell. Our view of the company and fair value have reduced. But the shares are now trading on an EV/DACF multiple discount of 4% to the global sector in 2005. With the current discount, the strong oil price and the dividend, we believe that Shell should offer a positive absolute return from here. Although tempting to follow sentiment, our numbers have not materially changed and we do not believe it is right to cut our recommendation after the horse has bolted. ("Royal Dutch: Proven reserve downgrade," UBS, January 9, 2004, p. 1.)

The reaction in the market was understandable and indeed, the shares may not yet have reached their lows. Nonetheless, we believe that the majority of the impact is on sentiment rather than value and that the reaction is overdone. On a 6 or 12 month view, we believe that the shares should rebound from the fall and regain their losses. We therefore have maintained our buy recommendation, although we are reducing our price target for

Royal Dutch from E46/share (\$59.1/ADR) to E44/share (\$56.5/ADR) and for Shell from 450p (\$49.9/share) to 435p (\$48.3/share). ("Royal Dutch: Proven reserve downgrade," UBS, January 9, 2004, p. 2.)

We are cutting our recommendations from Outperform to Neutral, as we believe that today's announcements about reserves have materially damaged the investment case. The disclosure of an improved, but lower-than-anticipated reserves 2003 replacement ratio range will not be enough to neutralise criticism of recent upstream performance, in our view. This, and news of a 20% cut in proved reserves may increase doubts about the group's ability to grow production in the future. We believe that the risk of a slackening of capital discipline to bolster reserves has now increased. ("Royal Dutch/Shell: Reserves disappointments," BNP Paribas, January 9, 2004, p. 1.)

The non-recurring, downward recategorisation of group proved reserves by 20% is unlikely to have a material, direct financial impact, in our opinion. Most of the reserves in question are expected to be re-booked as proved, over time. The depreciation charge in the future will be raised by a negligible amount ('a few tens of millions of dollars'). Future investment in existing projects is not directly affected by the announcement. ("Royal Dutch/Shell: Reserves disappointments," BNP Paribas, January 9, 2004, p. 1.)

However, we estimate that the recategorisation will leave a reserves life of only 10.3-10.5 years at the end of 2003, versus the previously indicated figure of 14.5 years at the end of 2002. This compares with a peer range of 12.4-15.2 years, which is clearly not comfortable. On balance, we judge that the risk of higher organic spending or an acquisition, to boost reserves life, have increased. ("Royal Dutch/Shell: Reserves disappointments," BNP Paribas, January 9, 2004, p. 1.)

95. This disclosure partially revealed the information relating to the amount of proved reserves and the methodology followed in determining the proved reserves that the Plaintiffs allege that the Defendants misrepresented or omitted.

96. Based on the extensive media and analyst coverage as well as the highly statistically significant stock price decline and high traded volume, I conclude that the January 9, 2004 disclosure relating to the reserve recategorization was material to investors and caused significant losses to the investors in Royal Dutch New York Shares and Shell Transport ADRs.

97. However, the January 9, 2004 disclosure failed to disclose: (i) the full extent of the reserve recategorization relating to reserves as of December 31, 2002; (ii) that the reserve recategorization would lead to a restatement of previously issued financial statements; and (iii) that much of the recategorized reserves would not be re-booked as proved reserves. Thus, the January 9 disclosure did not remove all the artificial inflation in Royal Dutch and Shell Transport equity securities caused by the alleged misrepresentations and omissions.

b) March 18, 2004

98. On March 18, 2004, Royal Dutch/Shell announced a further recategorization of an additional 250 million boe of proved reserves as at the end of 2002. In addition, 220 million boe of proved reserves (including volumes from Ormen Lange) were reduced from the proved reserves planned to be booked in 2003. The 220 million boe had been included in the reserve replacement ratio ("RRR") for 2003 disclosed on February 5, 2004. The reduction of 220 million boe from 2003 reserve additions resulted in a reduction of approximately 16 percentage points in the 2003 RRR. The Companies also announced an expected impact on earnings of approximately \$20 million and well write-off costs related to the original recategorization amounting to \$10 million after tax. In addition, the Companies announced steps already taken, in progress or being considered to strengthen internal controls and corporate governance.⁶⁰

⁶⁰ "SHELL TRANSPORT & TRADING CO PLC: Shell Announcement," PR Newswire, March 18, 2004, 7:16 AM.

99. This disclosure also resulted in significant price declines for Royal Dutch and Shell Transport equity securities. See Exhibit 7. The price of Royal Dutch New York Shares declined 1.24% or \$0.60 from the previous closing price of \$48.31, to close at \$47.71. The reported trading volume for Royal Dutch New York Shares of 6.8 million shares was more than twice the average reported volume of 2.4 million shares for 2003. The excess return of -1.70% was statistically significant. The excess price decline was \$0.82 (calculated as $-1.70\% \times \$48.31$).

100. The price for Royal Dutch Amsterdam Shares declined 3.34% or 1.32 euros from the previous closing price of 39.55 euros, to close at 38.23 euros. The reported trading volume was more than 30 million shares. The excess return of -2% was statistically significant.

101. The price for Shell Transport ADRs declined 1.34% or \$0.55 from the previous closing price of \$41.05, to close at \$40.50. The reported trading volume for Shell Transport ADRs of 698,200 ADRs was almost two times the average reported volume over 2003 of approximately 345,000 ADRs. The excess return of -1.79% was statistically significant. The excess price decline was \$0.74 (calculated as $-1.79\% \times \$41.05$).

102. The price for Shell Transport London Shares declined 2.96% or 11 pence from the previous day's closing price of 372 pence, to close at 361 pence. The reported trading volume was more than 133 million shares. The excess return for Shell Transport London Shares of -2.03% was statistically significant.

103. The March 18, 2004 disclosure was widely discussed in the media, as indicated by the following selected excerpts:

Heavily weighted oil giant Royal Dutch/Shell also weighed after news of a further downgrade of its oil reserves and a delay in publishing its annual report, due out Friday, until May.

Royal Dutch in Amsterdam and Shell in London fell more than three percent.⁶¹

Royal Dutch/Shell Group (RD SC) cut its estimate of its energy reserves for a second time and said it would postpone the publication of its annual report until it had further scrutinized holdings in its global oil and natural gas portfolios.

The surprise disclosure brings to 21% the amount by which Shell has slashed its reserves. It stunned investors and analysts, who had been looking forward to Shell's scheduled release of its annual report Friday to provide some clarity about the reserve debacle and some assurances that management had started to put the problem behind it.

Instead, the six-page morning release raised new questions, including worry whether Shell had further bad news to disclose on a conference call scheduled for 9 a.m. EST.

In midday trading in Europe, shares in Shell's two parent companies - Royal Dutch Petroleum Co. of The Hague and London-based Shell Transport & Trading Co. fell sharply.

Shell, the world's largest oil company by market capitalization, also said it wouldn't re-book as planned a large chunk of reserves that it had cut from its tally. In early January, Shell cut its reserves by 3.9 billion barrels of oil equivalent, or 20%. But executives said early last month that it would re-book some of those cuts.⁶²

104. Several analysts commented on the March 18, 2004 as indicated by the following selected excerpts:

The reserve downgrade amounts to an additional 250 mmboe in respect of the original 3.9 bnboe reserve downgrade and a 220 mmboe reduction to the amount reported to be booked as proved additions to reserves in 2003. Consequently reserve replacement in 2003 falls by 16% to 82%, including acquisitions. ("RD/Shell: Another reserves downgrade," Credit Suisse First Boston, March 18, 2004, p. 2.)

The further reserves downgrade leaves the reserve life at 10.5 years, 1 to 3 years below those of its peers with a three year

⁶¹ "European stock slip as earnings, Shell disappoint," Reuters News, March 18, 2004, 7:59 AM.

⁶² "WSJ UPDATE: Shell Cuts Energy Reserves Estimates Again," Dow Jones News Service, March 18, 2004, 9:05 AM.

organic finding and development cost that we calculate at US\$20.65/boe. ("RD/Shell: Another reserves downgrade," Credit Suisse First Boston, March 18, 2004, p. 3.)

In a surprise announcement, Royal Dutch/Shell has signalled the need for an additional, downwards recategorisation of its proved reserves. This reflects a shift in its internal investigations from questions about the timing of first reserves bookings to more technical questions about the quantity of reserves that were previously booked. ("Royal Dutch/Shell: Second (smaller) reserves recategorisation," BNP Paribas, March 18, 2004, p. 1.)

The recategorisation is much smaller than the one announced in January. However, it worsens the group's poor track record in exploration and we expect it to further dent confidence. Although management does not expect more adjustments to be made, further changes cannot be ruled out until the group's internal investigations are complete, at the end of April. ("Royal Dutch/Shell: Second (smaller) reserves recategorisation," BNP Paribas, March 18, 2004, p. 1.)

The overall impact of these measures is to cut previously indicated group reserves at the end of last year by 470mboe (2.4%). The reported, organic reserves replacement ratio for 2003 is also cut from 117% to 101%. ("Royal Dutch/Shell: Second (smaller) reserves recategorisation," BNP Paribas, March 18, 2004, p. 1.)

Two weeks on, Shell's new management team have unearthed new irregularities in reserves bookings, which will result in approximately 3% negative revision to group reserves (470 million boe), \$20 million of recurring P&L charges, and a \$10 million one-off charge. Norwegian gas field Ormen Lange was wrongly booked, and that 166 million boe downgrade to 90 million caused Brinded to bring in external consultants Ryder Scott to recheck group reserves. That process is 40% done, with a total downgrade so far of 470 million boe (3%), and should be complete by end-April. The new management lack confidence in the assessments of their predecessors, and have taken the only option left to restore credibility, namely to employ external auditors. ("COMPANY ALERT: Royal Dutch/Shell New management, new look," Deutsche Bank, March 18, 2004, p. 1.)

There are two negatives here: the reserves review isn't finished, and so the annual report has been delayed. E&P CEO Brinded felt

that there were no major downgrades left to come, but that remains a risk until end-April, when the group-wide review is due to complete (with the Q1 results?), and perhaps as late as end-May, when the annual report is now due. ("COMPANY ALERT: Royal Dutch/Shell New management, new look," Deutsche Bank, March 18, 2004, p. 1.)

105. The March 18, 2004 disclosure effectively fully disclosed the information relating to the publicly reported proved reserves that the Plaintiffs allege was misrepresented or omitted during the Class Period.

106. Based on the extensive media and analyst coverage, the significant stock price declines and high trading volume, I conclude that the information disclosed in the March 18, 2004 disclosure was material and caused losses to the investors.

c) April 19, 2004

107. On April 19, 2004 Royal Dutch/Shell announced that after review of 90% of the proved oil and gas reserves with external assistance, a total of 4.35 billion boe of proved oil and gas reserves as at the end of 2002 would be recategorized. The Companies also announced that 2003 proved reserves would fall by 0.5 billion boe. In addition, the Companies announced management changes and proposed steps to strengthen the proved reserve estimation process.⁶³

108. Also on April 19, 2004, Standard & Poor's announced that it had lowered the debt rating for the Royal Dutch/Shell Group from AAA to AA+.

109. The information disclosed in the April 19, 2004 announcements did not cause a statistically significant price reaction in the Royal Dutch New York Shares and Shell Transport ADRs.

⁶³ "SHELL TRANSPORT & TRADING CO PLC: Shell publishes audit and reserves reports," Bloomberg, April 19, 2004, 2:01 AM.

d) July 2, 2004

110. On July 2, 2004, the Companies filed an amended Form 20-F ("Amended Form 20-F") for the year ended December 31, 2002. In the Amended Form 20-F, 4.47 billion boe of proved oil and gas reserves were removed from the proved reserves as of December 31, 2002. The Amended Form 20-F provided the impact of the reserves restatement on the net income for the years 2000 through 2002 and the cumulative effect of the reserves restatement on the net income for the years prior to 2000. The Amended Form 20-F also provided details of the annual effect of the reserves restatement including the aggregated effect of the reserves restatement on the unaudited proved reserves volume as of the end of each year from 1999 through 2002.

111. There was no statistically significant price reaction in Royal Dutch New York Shares and Shell Transport ADRs on July 2, 2004.

iii. Summary

112. The Complaint alleges that Royal Dutch/Shell reported, in SEC filings and other public statements and documents, certain reserves as "proved reserves" from projects around the world, including, but not limited to, a project off the western coast of Australia called the Gorgon Joint Venture, and various projects in Nigeria. In fact, Royal Dutch/Shell later disclosed that the booked reserves did not meet the requirements of the SEC to be reported as proved, or even the Companies' own guidelines. In the Companies' Form 20-F/A for 2002 dated July 2, 2004, the Companies stated that 4.47 billion boe, representing 23% of the Companies' proved reserves as of December 31, 2002, would be removed from the proved reserve category. Plaintiffs allege that the reserves were improperly reported as proved reserves in Royal

Dutch/Shell's public statements and financial reports, thereby materially artificially inflating a key measure of the companies' financial position and competitive standing.

113. As discussed above, on January 9, 2004, Royal Dutch announced that it was going to write-down its proved oil and gas reserves by 20%, or 3.9 billion barrels, from 19.5 billion barrels to 15.6 billion barrels as of December 31, 2002. In addition, the Companies disclosed that the reserve replacement ratio for 2003 was expected to be in the range of 70-90%, representing the net addition of between 1.0 and 1.3 billion boe. Following the announcement, Moody's placed the Aaa rating of Royal Dutch/Shell under review for possible downgrade because the write-down materially and adversely affected the companies' reserves-to-debt ratio.

114. On March 18, 2004, Royal Dutch/Shell announced a further recategorization of additional 250 million boe of proved reserves as at the end of 2002. In addition, 220 million boe of proved reserves (including volumes from Ormen Lange) were reduced from the proved reserves planned to be booked in 2003.

115. In my opinion there is a strong correspondence or mapping between the elements contained in the alleged misrepresentations and the elements contained in these two disclosures. The elements of the January 2004 and the March 2004 disclosures either corrected the previously misrepresented statements or provided the consequences of the misrepresentations, such as the Moody's downgrade and the revision of the 2003 reserve additions.

116. In my opinion, the information in the January 2004 and March 2004 disclosures discussed above caused the significant stock price declines (net of market and industry) that I computed on each date. These stock price declines resulted in losses for Royal Dutch and Shell Transport investors.

117. In my opinion, Defendants' alleged misrepresentations and omissions during the Class Period concerning Royal Dutch/Shell's proved oil and gas reserves, were economically material. The January 9, 2004 and March 18, 2004 disclosures resulted in statistically significant stock price declines.⁶⁴

C. ARTIFICIAL INFLATION FOR EQUITY SECURITIES

118. Section 10(b) of the Securities Exchange Act of 1934 requires calculation of damages based on actual damages. In addition, the 90-day "look back" provision of the Private Securities Litigation Reform Act of 1995 ("PSLRA") provides a limit on the maximum amount of recoverable damages.⁶⁵ It is generally accepted that actual damages in Section 10(b) securities cases (involving fraud in connection with a purchase) are defined as the price paid for the security minus the "true value" of the security on the date of purchase. The difference between the purchase price and value is called "artificial inflation." To estimate damages, therefore, it is necessary to estimate the amount of artificial inflation in the security's price. I quantified the amount of artificial inflation present in Royal Dutch New York Shares and Shell Transport ADRs during the Class Period, assuming Defendants are found liable under Section

⁶⁴ Since discovery is currently ongoing, I reserve the right to amend this report. Such amendment may include the addition of more disclosures that removed artificial inflation.

⁶⁵ Section 21D(e)(1) of the PSLRA (15 U.S.C. §78u-4(e)(1)) provides that maximum amount of recoverable damages for securities purchased during the class period and retained through the 90-day period following the day on which the alleged misstatements or omissions were corrected ("90-day lookback period") are limited to the difference between the purchase price paid and the mean trading price of the security for the 90-day lookback period. Section 21D(e)(2) of the PSLRA (15 U.S.C. §78u-4(e)(2)) provides that if the security is sold during the 90-day lookback period, the maximum amount of recoverable damages are limited to the difference between the purchase price paid and the mean trading price for the security during the period beginning on the day on which the alleged misstatements and omissions were corrected and ending on the date of sale.

10(b) of the Securities Exchange Act, using Royal Dutch New York Shares and Shell Transport ADR price changes attributed to the alleged misstatements and omissions that I discussed above.

119. To quantify the amount of artificial inflation present in Royal Dutch New York Shares and Shell Transport ADR prices during the Class Period, assuming Defendants are found liable under Section 10(b) of the Securities Exchange Act, I first identified the days for which new information disclosed to the market caused the amount of artificial inflation to be reduced, resulting in significant declines in Royal Dutch New York Shares and Shell Transport ADR traded prices. As discussed in the previous section, the disclosures on January 9, 2004 and March 18, 2004 reduced the artificial inflation associated with the alleged misrepresentations and omissions. These disclosures caused significant price declines.

120. The following table presents the aggregated effect of unaudited proved oil and gas reserve volume (in million boe) for the years 1997 through 2002 and the restatement as percentage of total proved reserves originally stated in Form 20-F:

TABLE 1: SUMMARY OF THE EFFECT OF RESERVE RESTATEMENT ON THE PROVED OIL AND GAS RESERVES FOR THE YEARS 1997 THROUGH 2002						
	1997	1998	1999	2000	2001	2002
Aggregated effect on unaudited proved oil and gas reserve volume (million boe)	3,132	3,777	4,582	4,844	4,531	4,474
Restatement as percent of total proved reserves originally stated in Form 20-F	16%	19%	23%	25%	24%	23%
Estimated reduction in the total standardized measure of discounted future net cash flows for group companies and associated companies (\$ millions)			7,013	7,236	6,469	6,648
Estimated reduction in the standardized measure of discounted future net cash flows as percent of total standardized measure that was originally stated at that date			11%	13%	18%	9%

121. The above table shows that the effect on each of the measures for the years 1999 through 2001 is similar to or higher than the effect for the year 2002. For the year 1998, the aggregated effect on unaudited proved oil and gas reserve volume was 3,777 million boe, which is approximately 84% of the 4,474 million boe for 2002. The restatement as percent of total proved reserves originally stated in Form 20-F for 1998 is 19%, which is approximately 80% of the restatement as a percent of total proved reserves originally stated in Form 20-F of 23% for 2002. From April 8, 1999, the first day of the Class Period, through February 9, 2000, the day before the announcement of 1999 financial results and reserve replacement, the prices for Royal Dutch New York Shares and Shell Transport ADRs would be inflated by the overstatement of 1998 reserves. Therefore, to determine the percentage by which the price for Royal Dutch New

York Shares and Shell Transport ADRs were inflated during the period April 8, 1999 through February 9, 2000, I multiply the percentage of unadjusted artificial inflation on February 10, 2000 by 80% (see Exhibits 22 and 23 for daily artificial inflation in Royal Dutch New York Shares and Shell Transport ADRs).

122. I calculate the amount of artificial inflation present in prices for Royal Dutch shares traded on the Euronext/Amsterdam Exchange by multiplying the daily price on that Exchange by the percentage artificial inflation for the Royal Dutch New York Shares on the respective day (see Exhibit 24).

123. Similarly, I calculate the amount of artificial inflation present in prices for Shell Transport shares traded on the LSE by multiplying the daily price on that Exchange by the percentage artificial inflation for the Shell Transport ADRs on the respective day (see Exhibit 25).

D. ARTIFICIAL INFLATION (DEFLATION) FOR CALL (PUT) OPTIONS

124. Options are a type of “derivative” financial security whose value is dependent on the value of another financial security or asset, such as Royal Dutch New York Shares or Shell ADRs. There were both call and put options available on Royal Dutch New York Shares and Shell ADRs throughout the Class Period. Call options give the holder the right, but not the obligation, to purchase Royal Dutch New York Shares or Shell ADRs at a specified price (the “exercise” or “strike” price) on or before a specified date (the “expiration date”). Put options give the holder the right, but not the obligation, to sell Royal Dutch New York Shares or Shell ADRs at a specified price on or before a specified date.

125. At expiration, the value of an option is the difference between the underlying security's price ("S") and the option's exercise price ("X"). This difference is called the "intrinsic value" of an option. For a call option, at expiration the intrinsic value is equal to $S - X$, but not less than zero. For example, a call option with $X = \$50$ will be worth \$10 at expiration if the stock is trading at \$60 (the stock valued at \$60 can be purchased for \$50), and worth \$0 if the stock is trading at or below \$50. Because the option holder does not have an obligation to exercise her option, the value of an option cannot decline below zero. For a put option, at expiration the intrinsic value is equal to $X - S$, but not less than zero. For example, a put option with $X = \$50$ will be worth \$10 at expiration if the stock is trading at \$40 (the stock valued at \$40 can be sold for \$50), and worth \$0 if the stock is trading at or above \$50.

126. Because a call option gives the buyer the right to buy a share of stock at a fixed price, call option prices generally increase when the share price increases, all other things equal. Thus, if Royal Dutch New York Shares and Shell ADRs were artificially inflated, call options on these securities would likely be inflated as well. Artificial inflation in call option prices will cause purchasers of call options to be damaged by an amount equal to the difference between the artificial inflation in the call option price at the time of purchase and the amount of artificial inflation in the call option price when they close out their position.⁶⁶

127. Because a put option gives the seller the right to sell a share of stock at a fixed price, put option prices generally increase when the share price decreases, all other things equal. Thus, if Royal Dutch New York Shares and Shell ADRs were artificially inflated, put options on

⁶⁶ Option purchasers and sellers generally "close out" their positions by taking an off-setting position prior to expiration, or settling up for the option value at expiration (either in stock or cash).

these securities would likely be artificially deflated. Artificial deflation in put option prices will cause sellers of put options to be damaged by an amount equal to the difference between the artificial deflation in the put option price at the time of sale and the amount of artificial deflation in the put option price when they close out their position.⁶⁷

i. Market Efficiency of Options

a) Correlation between Stock and Option Price Changes

128. Because options derive their value from an underlying security, if the underlying security is trading in an efficient market, then one can measure the efficiency of the option market by measuring the correlation between stock price changes and option price changes. I therefore first examine the correlation between stock and option price changes.

129. I performed a statistical test on whether the prices of options on Royal Dutch New York Shares and Shell ADRs moved in tandem with prices of the underlying securities. I compared the actual option price change on a daily basis with the option price change that would be expected from the movement in the underlying stock over the same period. The predicted option price change was based on the option's "delta," which is a measure of how much an option price is expected to change with a movement in the underlying security's price, holding all else constant.⁶⁸ The delta of a call option is given as $N(d_1)$, and the delta of a put option is

⁶⁷ For simplicity of exposition, I will sometimes refer to the "artificial inflation" in Royal Dutch New York Shares and Shell Transport ADR call and put options. When this term is applied to put options, it should be interpreted as artificial deflation.

⁶⁸ Delta will give a less accurate predicted option price change as the price change in the underlying security becomes larger because delta is a linear measure while option prices are convex with respect to the price of the underlying security. See, for example, R. Stulz, *Risk Management & Derivatives*, Thomson South-Western: USA, 2003, pp. 368-370.

given as $N(d_1) - 1$,⁶⁹ which are calculated based on the Black-Scholes option pricing formula, described below.

130. I first obtained from FT-Interactive Data Corp a list of option identifiers for all options on Royal Dutch New York Shares or Shell ADRs. I removed any options that expired prior to January 2004, because these options would have been closed out prior to any disclosure of the alleged misrepresentations and/or omissions. I next downloaded open interest in these options from January 8, 2004 through March 18, 2004, spanning the time period from the date of the January 2004 disclosure through the day after the March 2004 disclosure.⁷⁰ I identified those options that had no open interest over this period. If all of the options in an options series, as defined by those options with the same expiration date (both put and call, at any exercise price) had no open interest, then I removed that option series from my analysis.

131. I next downloaded bid and ask prices for each remaining option from November 2001 through March 2004.⁷¹ I use bid and ask prices because there is less consistent trading in any one option contract on a daily basis, and the bid and ask prices allow me to obtain more accurate pricing information. For options that had both a bid and an ask price on a given date, I calculated the bid-ask midpoint for each of these options.

132. I next calculated the implied volatility of each option with a bid-ask midpoint. Implied volatility is one of the determinants of the price of an option, and refers to the variability of the underlying security. The greater the variability of the underlying security, the more

⁶⁹ See, for example, J. Hull, *Options, Futures, and Other Derivatives, Fifth Edition*, Prentice Hall: New Jersey, 2003, p. 303. For an option on an asset with a continuously compounded yield of q , the delta's are multiplied by e^{-qT} (Hull, pp. 304-305).

⁷⁰ Open interest is the number of outstanding option contracts at a given point in time.

⁷¹ I chose November 2001 because it was the first month where any open interest existed in any of the options in my sample.

valuable options become, holding all else constant. The implied volatility is a key input in option pricing formulas.

133. Options can be priced using the widely-accepted Black-Scholes formula. The Black-Scholes option pricing model is taught universally and is ubiquitous in financial practice. Indeed, the Black-Scholes option pricing model or its variants are the most common model for valuing options of all types. Numerous empirical studies attest to its reliability, and numerous courts have accepted options valuations based on the Black-Scholes options pricing model. The formula was developed by Fischer Black and Myron Scholes in the early 1970s.⁷² The Black-Scholes pricing formula uses risk neutral valuation to create a portfolio that mimics an option's expected payoff, and thus enables a mathematically rigorous pricing of an option.⁷³ The Black-Scholes Formula, adjusted for dividends is:

$$\begin{aligned}
 c &= Se^{-qt} N(d_1) - Xe^{-rt} N(d_2) \\
 &\text{and} \\
 p &= Xe^{-rt} N(-d_2) - Se^{-qt} N(-d_1), \\
 &\text{where} \\
 d_1 &= \frac{\ln(S/X) + (r - q + \sigma^2/2)(T)}{\sigma\sqrt{T}} \\
 &\text{and} \\
 d_2 &= d_1 - \sigma\sqrt{T}.
 \end{aligned}$$

⁷² See F. Black and M. Scholes, "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy* 81, May-June 1973, 637-654. Myron Scholes, along with Robert Merton, were awarded Nobel prizes for their work in developing option pricing models. Unfortunately, Fischer Black had passed away when the Nobel prizes were awarded.

⁷³ Richard Merton adjusted the original Black-Scholes model to accommodate dividend paying stocks. See R.C. Merton, "Theory of Rational Option Pricing," *Bell Journal of Economics and Management Science*, Spring 1973, 141-83; J. C. Hull, *Options, Futures, and Other Derivatives, Fifth Edition*, Prentice Hall: New Jersey, 2003, pp. 268-269.

where:

- c = the price of a call option;
- p = the price of a put option;
- S = the current stock price underlying the option;
- σ = the volatility of the underlying stock;
- X = the exercise price of the option;
- T = the time to the expiration of the option;
- q = the dividend yield on the underlying stock;
- r = the risk-free interest rate; and
- N denotes the cumulative probability distribution function for a standardized normal distribution.

134. Given the value of an option and the other observable inputs, the implied volatility can be solved using an iterative process. I set S equal to the underlying stock's closing price, X equal to the expiration date of the option, T equal to the number of days to expiration divided by 365, r set to the U.S. Treasury constant maturity rate closest to days to expiration,⁷⁴ and q equal to 2%.⁷⁵ Where possible, I solved for implied volatility.

135. After calculating implied volatility, I then calculated the delta of the options on a daily basis based on the formulas described above. I then multiplied the change in price of the underlying security each day by the option delta from the previous day to yield an estimate of the predicted option price change on that day.

136. I thus had a sample for each option on each day (where inputs were available) of the option's actual price change and its predicted price change.⁷⁶ Panel A of Exhibit 26 is a

⁷⁴ Interest rate data was obtained from the FRED® (Federal Reserve Economic Database) database available at <http://research.stlouisfed.org/fred2/>. The following cut-offs were used in assigning interest rates to time to maturity: 1-60 days, 1 month rate; 61-136 days, 3 month rate; 137-273 days, 6 month rate; 274-547 days, 1 year rate; 548-912 days, 2 year rate; 913-1,460 days, 3 year rate; and over 1,460 days, 5 year rate.

⁷⁵ I used a 2% yield as a simplifying assumption for this analysis.

⁷⁶ The dataset totals 19,450 option/date observations with valid data.

scatter plot of the predicted option price change (x-axis) against the actual option price change (y-axis). A positive correlation is very evident in the scatter plot.

137. I next performed a regression analysis of the actual price change against the predicted price change for those options that were relatively close to "at-the-money." An option that is at-the-money has an exercise price equal to the current stock price.⁷⁷ I would expect that the regression intercept term would be zero and that the coefficient on the predicted price change would equal 1. The regression resulted in an intercept of approximately zero and a coefficient on the predicted option price change of approximately 1.02. The adjusted r-squared from this regression was approximately 91%, meaning that 91% of the variation of the option price changes could be explained by variation in the predicted option price changes. See Panel B of Exhibit 26. In general, the option prices do move in a manner that would be expected based on the movement in the underlying security, supporting a conclusion that the option markets were also informationally efficient.⁷⁸

b) Put-Call Parity

138. I also performed an analysis on whether options on Royal Dutch New York Shares and Shell ADRs violated put-call parity. A combination of put and call options, in addition to an investment in a risk-free asset, can be combined, in theory, to create the same mathematical payoff as owning the underlying security.⁷⁹ Algebraically, put-call parity is:

⁷⁷ If the stock price was within 10% of the option's exercise price, I considered it close to at-the-money. The sub-sample of at the money options totaled 6,633 option/date observations.

⁷⁸ I also ran the regression separately for options on the two companies. The results were qualitatively similar. Approximate regression statistics for Royal Dutch and Shell options were, respectively: observations, 5,475 and 1,158; intercept, 0.00 for both; coefficient, 1.01 and 1.06; adjusted r-squared, 91% and 94%.

⁷⁹ See, for example, J. Hull, *Options, Futures, and Other Derivatives, Fifth Edition*, Prentice Hall: New Jersey, 2003, pp. 174-175. An adjustment can be made for dividends and for

$$S = C + Xe^{-rT} - P,$$

where

S = the price of the underlying security,

Xe^{-rT} = the present value of the exercise price,

C = the price of a call, and

P = the price of a put.

139. I tested for violations of put-call parity using the methodology described by Evans, Geczy, Musto and Reed ("EGMR") in a recent 2005 paper.⁸⁰ EGMR calculate the disparity between the actual stock price and the price predicted from put-call parity as a percentage:

$$\text{Disparity} = (S - S^i)/S,$$

where

S is the actual stock price, and

S^i is the price predicted from put-call parity.

140. For the dataset of options described previously, I used the bid and ask midpoints of puts and calls matched by exercise price and expiration date to calculate an expected stock price each day.⁸¹ I restrict the dataset to option pairs that meet the conditions EGMR specified in Table I. These restrictions yield 1,445 option pairs.⁸²

"American" style options. For simplicity, I used the basic put-call parity equation.

⁸⁰ R. Evans, C. Geczy, D. Musto and A. Reed, "Failure is an Option: Impediments to Short Selling and Option Prices," working paper, 2005.

⁸¹ I use a risk-free rate as defined previously.

⁸² The restrictions include removing the following options: call or put price less than \$0.375; time to maturity greater than 180 days; time to maturity less than 6 days; call price greater than stock price; call price less than the stock price minus the present value of the exercise price; put price less than the exercise price minus the stock price; and put price greater than the exercise price.

141. On average the disparity is 0.50%, similar to the average disparity reported in EGMR of 0.36% (Table III).⁸³ For simplicity, I did not include dividends in my calculation of S^i , which will understate the correct S^i and overstate the measured disparity. Based on the methodology of EGMR, Royal Dutch and Shell options do not significantly violate the put-call parity arbitrage condition, and are consistent with an efficient market.

ii. Artificial Inflation/Deflation

142. I determined the artificial inflation present in options on Royal Dutch New York Shares and Shell Transport ADRs based on an estimate of the price changes, net of market and industry effects, of the options on the disclosures in January and March 2004. I used the same dataset described previously, limiting the data to January 8-9, 2004 and March 17-18, 2004.

143. I calculated the implied volatility based on the Black-Scholes formula of each option with a bid-ask midpoint on the disclosure dates: January 9, 2004 and March 18, 2004. Given the value of an option and the other observable inputs, the implied volatility can be solved using an iterative process. I set S equal to the underlying stock's closing price, X equal to the expiration date of the option, T equal to the number of days to expiration divided by 365, r set to the U.S. Treasury constant maturity rate closest to days to expiration,⁸⁴ and q equal to the

⁸³ By company, there are 1,045 Royal Dutch observations with an average disparity of 0.35% and 400 Shell observations with an average disparity of 0.88%.

⁸⁴ Interest rate data was obtained from the FRED® (Federal Reserve Economic Database) database available at <http://research.stlouisfed.org/fred2/>. The following cut-offs were used in assigning interest rates to time to maturity: 1-60 days, 1 month rate; 61-136 days, 3 month rate; 137-273 days, 6 month rate; 274-547 days, 1 year rate; 548-912 days, 2 year rate; 913-1,460 days, 3 year rate; and over 1,460 days, 5 year rate.

dividend yield based on previous year's gross dividend from Bloomberg, assuming similar ex-dates for 2004.⁸⁵ Where possible, I solved for implied volatility.

144. I next calculated the Black-Scholes value of each option on January 8, 2004 and March 17, 2004, the trading day prior to the disclosure dates. These calculations were made for those options with valid bid-ask midpoints on the specified date. The Black-Scholes model was applied as above with the following changes: S was set to the price of the stock in question less the excess price change of the stock over the disclosure;⁸⁶ and the implied volatility was set equal to the implied volatility calculated for the following day. If it had not been possible to solve for the implied volatility on the following day, the implied volatility of the closest option was chosen. The option chosen would be the same side (call or put) and have the same expiration date, and then have the closest expiration price.

145. This Black-Scholes value is thus the value of the option on the day prior to the disclosure if the stock had declined solely for company-specific events as measured by the excess price change on the disclosure date. The excess option price change was then calculated by taking the difference between the estimated value of the option and the actual price of the option. Between January 9, 2004 and March 17, 2004, the artificial inflation in the option is

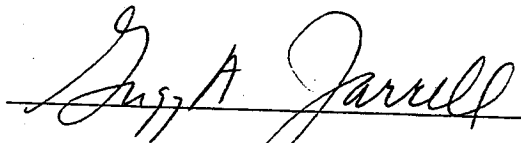
⁸⁵ The dividend yield is calculated based on the amount of dividend that would payable to the stock prior to the expiration of the option. Both securities paid two dividends per year. Thus, if an option expired prior to the first assumed ex-date, a dividend yield of zero was given. If an option expired after the first ex-date but prior to the next assumed ex-date, the dividend yield was calculated based on the first assumed dividend. Finally, if the option expired after the second assumed ex-date, the dividend yield was calculated based on the total of the assumed dividends.

⁸⁶ This yields the value of the stock on that day absent the price change (net of market and industry effects) associated with the disclosure i.e., it is the value of the option assuming a hypothetical stock price decline equal to the measured excess price change on the disclosure date.

equal to the excess price change in the option attributed to the March 18, 2004 disclosure. From November 2001 through January 8, 2004, the artificial inflation is each option is equal to the sum of the excess price changes in the option attributed to the January 9, 2004 and March 18, 2004 disclosures. The artificial inflation is only estimated backwards until November 2001 because that was the month with the first obtainable data on any of the options analyzed. Therefore, these options had not started trading prior to November 2001, according to the data I was able to obtain. See Exhibit 27 for the artificial inflation/deflation for Royal Dutch options and Exhibit 28 for the artificial inflation/deflation on Shell Transport options.

Nov. 3, 2006

Date


Gregg A. Jarrell