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Sources of Information

Changes to accounting rules for publicly traded companies have dramatically altered the availability of information on corporate risk management activities. Previous to these changes, risk management activities were typically viewed as a source of competitive advantage and only limited and indirect information was available, e.g., surveys. Accounting initiatives in the US and internationally that date from the beginning of the new millennium now require that the audited financial statements for publicly traded companies include a number of risk management related items. In the particular case of the US 10-K filing, Item 1A on risk factors and Item 7A on quantitative and qualitative disclosure of market risk, supplemented by information from the notes to the financial statements, provide discussion of essential issues. In addition, the balance sheet, income statement and cash flow statement can also explicitly include risk management items.¹ Finally, detailed notes on risk management activities are now provided. Though not as rigidly classified, filing requirements for publicly traded companies in Canada, Australia, Singapore, Switzerland and many other jurisdictions also require similar information to be provided. The discussion in this chapter is largely based on information provided in the regulatory filings of publicly traded companies in Canada, the US, Australia and Singapore.

Much of the discussion in this section is based on information obtained from the annual reports or 10-K filings for 2009 or 2010, depending on when the material was prepared. Though risk management strategies can change significantly when unforeseen events impact corporate strategy, this is not usually the case over a one or two year period. In the tradition of the 'value investing' approach to equity security valuation, the approach used in the following is 'bottom up' as opposed

to the ‘top down’ approach of academic studies that seek sources of commonality or homogeneity in risk management practices across firms. Unlike the ‘case approach’ popularized by the Harvard Business School in the US and the University of Western Ontario in Canada, the analysis is ‘real time’ and does not focus on lessons to be learned from a specific event. The primary objective is to describe the commodity risk management activities of specific firms in mining, oil and gas exploration and airline sectors as reflected in selected sections of public filings. In the process, substantive differences in commodity risk management activities across sectors and between firms in the same sector becomes apparent.

Overview

Academic studies of commodity risk management usually find that activities such as hedging are value increasing for firms. Some studies even report a point estimate for the percentage value increase in value attributed to risk management activities. Other studies suggest the use of active hedge adjustment based on hedge ratios that empirically estimated using advanced econometric techniques. In the process, theoretically derived rationales for commodity risk management, such as the under-investment hypothesis, are tested. The general message is that commodity risk management activities such as hedging are beneficial and firms that do not employ such methods are, somehow, not maximizing value for shareholders. Yet, detailed examination of the relevant sections of the financial statements for major commodity producing and consuming corporations reveals a different picture. In the process of detailing commodity risk management practices at major firms, questions decidedly more relevant to the commodity risk management decisions of non-financial firms become apparent.

Whether commodity risk management activities are ‘value enhancing’ raises the fundamental *ex ante* / *ex post* quandary that plagues ‘scientific’ commodity risk management. Completely accurate *ex ante* forecasts will produce optimal *ex post* operating and financial results. However, complete accuracy is a difficult target to achieve and some firms may opt to avoid the possibility of negative *ex post* outcomes. This quandary is aptly recognized below by Southwest Airlines Company, an active hedger of jet fuel price risk. In addition, management may correctly feel that shareholders want exposure to the underlying commodity price and hedging the commodity price would defeat this objective. Details for such a firm -- Canadian Oil Sands Limited -- are given below. All firms examined below are acutely aware of the difficulties associated with forecasting essential commodity prices but there is considerable diversity regarding the approach to managing the commodity price risk. This diversity is reflected in the range of instruments used to hedge the risk, including: OTC forward contracts; exchange traded futures contracts; commodity swaps; ‘costless collars’; out-of-the money puts (for producers) and calls (for consumers); leveraging; and, basis swaps.

3.1 Mining Companies

A. Non-Ferrous Metals: Freeport McMoRan and Capstone Mining,

Freeport McMoRan Copper and Gold Inc. (FCX)

“On limited past occasions, in response to market conditions, we have entered into copper and gold price protection contracts for a portion of our expected future mine production to mitigate the risk of adverse price fluctuations. We do not currently intend to enter into similar hedging programs in the future”. (FCX 10-K, p.101)

Headquartered in Phoenix, AZ, FCX exhibits a striking characteristic of many mining company operations: the absence of significant commodity risk management activities. This absence of hedging extends to both commodity prices of both mine outputs and mine inputs. As an example of the potential for hedging input costs, FCX report that:

copper mining operations require significant energy, principally electricity, diesel, coal and natural gas. Energy costs approximated 20 percent of our consolidated copper production costs in 2010 and 2009, and included purchases of approximately 215 million gallons of diesel fuel; 6,100 gigawatt hours of electricity at our North America, South America and Africa copper mining operations (we generate all of our power at our Indonesia mining operation); 800 thousand metric tons of coal for our coal power plant in Indonesia; and 1 million MMBTU (million British thermal units) of natural gas at certain of our North America mines. For 2011, we estimate energy costs will approximate 20 percent of our consolidated copper production costs.

Where derivative securities are employed, this usage is often associated with purchase and sale contracts that have embedded forward contracting provisions. FCX is an excellent example of these observations. The 2010 10-K for Freeport gives the following description of the company:

“We are one of the world’s largest copper, gold and molybdenum mining companies in terms of reserves and production. Our portfolio of assets includes the Grasberg minerals district in Indonesia, significant mining operations in North and South America, and the Tenke Fungurume (Tenke) minerals district in the Democratic Republic of Congo (DRC). The Grasberg minerals district contains the largest single recoverable copper reserve and the largest single gold reserve of any mine in the world based on the latest available reserve data provided by third-party industry consultants. We also operate Atlantic Copper, our wholly owned copper smelting and refining unit in Spain. “

Prior to the 2007 acquisition of Phelps Dodge, the primary asset of FCX was the Grasberg mining operation. The current corporate structure and mine locations are given in Figures 1.A.a and 1.B.b. The structure of consolidated mining output to copper, gold and molybdenum and reliance of FCX revenues and operating to each mineral is given in Figure 1.A.c.

INSERT Fig. 1.A.a FCX Corporate Structure
 INSERT Fig. 1.A.b FCX Mine Location
 INSERT Fig. 1.A.c FCX Mine Operating Data

FCX is acutely aware of the exposure of Company operations to price of copper and, to a lesser extent, gold and molybdenum (see Figure 1.A.d from 2010 10-K). The following information is provided in Item 7A, Quantitative and Qualitative Disclosures about Market Risk of the 10-K:

"Commodity Price Risk

Our consolidated revenues include the sale of copper concentrates, copper cathodes, copper rod, molybdenum, gold and other metals by our North and South America mines, the sale of copper concentrates (which also contain significant quantities of gold and silver) by our Indonesia mining operations, the sale of copper cathodes and cobalt hydroxide by our Africa mining operations, the sale of molybdenum in various forms by our Molybdenum operations, and the sale of copper cathodes, copper anodes and gold in anodes and slimes by Atlantic Copper. Our financial results can vary significantly as a result of fluctuations in the market prices of copper and, to a lesser extent, gold and molybdenum. World market prices for these commodities have fluctuated historically and are affected by numerous factors beyond our control. Because we cannot control the price of our products, the key measures that management focuses on in operating our business are sales volumes, unit net cash costs and operating cash flow."

INSERT Fig. 1.A.d FCX Copper Price Chart

The implied risk management philosophy appears to be based on an inability to "control", i.e., accurately predict, future prices. In an environment of on-average rising prices (see Fig. 1.A.c) for the commodities being mined, such a view makes sense. By focussing on "sales volumes, unit net cash costs and operating cash flow" FCX is exhibiting a general theme in commodity risk management found in other sectors. For example, Bergfjord (2009) finds for aquaculture firms in Norway that: "keeping costs low is the most important risk management tool"

Further information about risk management philosophy at FCX is obtained in the notes to the financial statements:

"FCX does not purchase, hold or sell derivative financial instruments unless there is an existing asset or obligation or if it anticipates a future activity that is likely to occur and will result in exposure to market risks and FCX intends to offset or mitigate such risks. FCX does not enter into any derivative financial instruments for speculative purposes, but has entered into derivative financial instruments in limited instances to achieve specific objectives. These objectives principally relate to managing risks associated with commodity price, foreign currency and interest rate risks. The fair values of FCX's financial derivative instruments are based on widely published market closing prices."

Though this statement has some of the typical boilerplate common in similar statements made by mining companies also not engaged in management of commodity price risk with derivative security

contracts, FCX does make substantive use of forward contracting provisions in purchase and sale contracts associated with “an existing obligation”. FCX describe these contracting provisions as:

For 2010, 52 percent of our mined copper was sold in concentrate, 26 percent as cathodes and 22 percent as rod (principally from our North America copper mines). Substantially all of our copper concentrate and cathode sales contracts provide final copper pricing in a specified future period (generally one to four months from the shipment date) based primarily on quoted LME monthly average spot prices.

In effect, FCX receives a market price that is based on prices in a specified future period. FCX record revenues and invoices customers at the time of shipment based on then-current LME prices. In the accounting process, the resulting embedded derivative in the forward sale contract is adjusted to fair value through earnings each period, using the period-end forward prices, until the date of final pricing "some one to four months from the shipment date". FCX recognizes that the embedded derivative will impact earnings.

certain FCX copper concentrate, copper cathode and gold sales contracts provide for provisional pricing primarily based on LME or COMEX prices (copper) and the London Bullion Market Association price (gold) at the time of shipment as specified in the contract. Similarly, FCX purchases copper and molybdenum under contracts that provide for provisional pricing (molybdenum purchases are generally based on an average Metals Week Molybdenum Dealer Oxide price).... the contracts do not allow for net settlement and always result in physical delivery. Sales and purchases with a provisional sales price contain an embedded derivative (i.e., the price settlement mechanism that is settled after the time of delivery) that is required to be bifurcated from the host contract. The host contract is the sale or purchase of the metals contained in the concentrates or cathodes at the then-current LME or COMEX price (copper), the London Bullion Market Association price (gold) or the average Metals Week Molybdenum Dealer Oxide price (molybdenum) as defined in the contract. Mark-to-market price fluctuations recorded through the settlement date are reflected in revenues for sales contracts and in cost of sales as production and delivery costs for purchase contracts.

The actual amount of metal production covered by such embedded derivative contracts is indicated in Figure 1.A.e. As of the end of 2010, FCX had no outstanding positions or credit exposure in financial derivative securities for either foreign exchange or interest rates. The bulk of outstanding long term debt is fixed rate US dollar and, despite having a sizable revolving credit facility, only a small amount of the facility has been drawn down.

Capstone Mining (TSX Ticker CS)

Headquartered in Vancouver, B.C., Capstone Mining Corp. is a mining company with two producing copper mines, the Cozamin copper-silver-zinc-lead mine located in Zacatecas State, Mexico and the Minto copper-gold-silver mine in Yukon, Canada. Over 85% of revenues are from copper. In addition to these two producing mines, Capstone also has two development projects, the

large scale 70% owned Santo Domingo copper-iron-gold project in Chile, in partnership with Korea Resources Corporation, and the 100% owned Kutcho copper-zinc-gold-silver project in British Columbia. In addition, Capstone has other smaller exploration properties. Having producing mines in place with an average cash cost for copper of \$1.40/lb. , CS is able to access bank credit facilities and the long term debt market. Terms of a large facility with Macquarie Bank required CS to maintain a program of forward pricing. In conjunction with a move to rollout of the Macquarie Bank financing, as illustrated in Figures 1.A.f , 1.A.g and 1.A.h., during 2010 Capstone was in the process of closing out hedge positions using forward purchases. Even with considerable activity in this area, pProduction hedged for Q4 2010 was approximately 55% for copper @ 2.10\$/lb; 27% for zinc @ 0.94\$/lb; and, 66% for lead @ 1.05\$/lb.

INSERT Figure 1.A.f Capstone Metal Sales
 INSERT Figure 1.A.g Capstone Mining Hedges
 INSERT Figure 1.A.h Hedging Results for Capstone

The progression of the program unwinding is capturing in the quarterly reports for 2011:

As a condition of the loans with Macquarie Bank Limited ("Macquarie"), the Company maintains a price protection program of copper forward sales contracts as they relate to the Minto Mine. These contracts expire in October 2011 and will be fully settled in early November 2011. Additionally, the Company has used forward sales contracts to manage price risk on a portion of its future production.

During the third quarter of 2010, the Company entered into copper forward purchase contracts at the corporate level to offset its outstanding copper forward sales contracts. This decision was made to allow the Company to participate in any future copper price increases. As at September 30, 2011, approximately 7.1 million pounds or 46% of the 15.6 million pounds of the outstanding copper forward sales contracts had been offset.

And, finally, the company reports:

During October 2011 the Company entered into additional copper forward purchase contracts at the corporate level to offset its remaining outstanding copper forward sales contracts. This decision was made to allow the Company to participate in any future copper price increases. As at October 31, 2011, 100% of the outstanding copper forward sales contracts had been offset. The offsetting copper forward purchase contracts locked in an approximate \$1.0 million gain on an equivalent number of copper forward sales contracts and provide the Company exposure to any copper price movement going forward. The locked in gain will be included in the results of operations for the three months ended December 31, 2011.

In addition to rolling out of all longer dated forward sales contracts leaving full exposure to commodity price risk, the company is rapidly expanding equity capital to eliminate long-term debt and acquire new development assets with the purchase of Far West Mining Ltd. in June 2011:

Far West Mining Ltd ("FWM"), a 70% owned Canadian subsidiary, owns 100% of Minera

Lejano Oeste, which is advancing the Santo Domingo project, a large scale copper-iron-gold project ("Santo Domingo") in Chile to a production decision. In addition FWM owns active exploration properties in Australia. Kutcho Copper Corp. ("Kutcho Copper"), a wholly-owned Canadian subsidiary of the Company, is advancing the Kutcho copper-zinc-silver-gold project (the "Kutcho Project") in British Columbia towards a production decision.

Capstone has no substantial interest rate risk to hedge. The considerable FX risk is related to the US\$, C\$ and Mexican peso. Capstone does not hedge FX risk.

B. Gold Miners: Barrick Gold (ABX)

The transition of CS from output sales prices largely hedged to fully unhedged is the latest in a sequence of such changes at different commodity producing firms in reaction to the general upward trend in all commodity prices, e.g., AngloGold Ashanti raised some \$1.3 billion to eliminate its hedge positions. Such changing corporate views toward output price hedging confound the results of academic studies on gold miners, e.g., Adam and Fernando (2006, 2008); Tufano (1996), that draw conclusions based on empirical evidence from the 1980's and 1990's when gold prices were trending downward and hedging was able to extract a "persistent positive realized risk premium" (Adam and Fernando 2008, p.87) from the contango in gold forward and futures price structures. The persistent upward trend in gold prices in the first decade of the 21st century undermined the validity of such conclusions.

Perhaps the most widely examined of such hedge book changes occurred with Barrick Gold, a company which in the early 1990's claimed great success for a hedging program that was ultimately unwound at considerable cost. While the FCX Grasberg operation can lay claim to being the largest gold mine currently in production, Barrick Gold (ABX) can lay claim to being the single largest gold producer, with the largest market capitalization and proven reserves. ABX became a public company in May 2, 1983 when it was listed on the Toronto Stock Exchange. With 140 million ounces of proven and probable gold reserves as of December 31, 2010, ABX also has 6.5 billion pounds of proven and probable reserves of copper and 1.07 billion ounces of proven and probable reserves of silver as of December 31, 2010. The headquarters of ABX are in Toronto, Ontario. Currently Barrick operates in Australia, Africa, North America, and South America with a portfolio of 26 operating mines (see figures 1.B.b & 1.B.c).

INSERT Figure 1.B.a Barrick Gold Financial Highlights
 Insert Figure 1.B.b Barrick Mines in North America and South America
 Figure 1.B.c Barrick Mines in Africa and Australia

The majority of Barrick's current production comes from North and South America (see figure 1.B.d).

Insert figure 1.B.d

Based on Barrick reserves it appears that the percentage of Barricks total production coming from Australia will increase in the future (see figure 1.B.e).

Insert figure 1.B.e

Retiring Barrick's Hedge Book

The tale of the Barrick hedge book is legendary in the annals of commodity risk management. The decision to reverse a long held positive view on fully hedging gold output was formally announced in Nov. 2003 but was apparent to the market as early as Feb. 2002. “In 2003 we adopted a no hedge policy” (ABX Annual Report 2003). At the time of the formal announcement, the accumulated Barrick hedge book was 16.3 million oz., reduced from the hedge book entering 2003 of 18.1 million oz. By comparison, in 2003, Barrick produced 5.51 million oz. of gold at a total cash cost of \$189/oz. Foster (2003) estimates the global hedge book for gold to be 71.6 million oz., making this reversal an omen for ‘the death of hedging’ by gold producers. In 1998, a year where Barrick produced 3.2 million oz. of gold, the Annual Report gives the following description of hedging activities using forward sales:

“As part of its gold hedging program, the Company has entered into spot deferred contracts with several major financial institutions to deliver 11.5 million ounces of gold. A spot deferred contract represents a forward sale on which contango accrues until the intended delivery date of the contract. The rate at which contango accrues is determined by LIBOR interest rate less the gold lease rate existing at the time of each rollover. The contracts have an average price of \$357 per ounce at December 31, 1998. The Company’s expected gold production is fully hedged over the next two years and it has further contracts in place designated from 2001 to 2004. Delivery under these spot deferred contracts can be deferred at the Company’s option for up to 15 years.”

Barrick’s gold hedging strategy extended beyond forward sales contracts to include options trading. For example, in 1998 the following positions were in place:

“In addition, the Company has entered into long-term written gold call options in respect of 1.7 million ounces. The call options have an average strike price of \$380 per ounce and expire at various dates over the period from 2000 to 2007. In the event that they are exercised at their maturity date, the Company has the intent and ability to convert them into spot deferred contracts at the strike price.”

In 2009, Barrick used \$3.4-billion of proceeds from a stock sale to buy back all of its fixed-price contracts and the majority of its floating spot price contracts. From 2004 to 2009, Barrick's hedge book liabilities more than doubled, rising to \$5.6-billion from \$1.9 billion. By moving into an unhedged position, allowed Barrick’s gross margins per ounce to be more leveraged to the price of gold.

Barrick’s Risk Exposures

Though reports of Canadian filing companies do not have the helpful structure of US firms filing

a 10-K where information on risk management activities is relatively standardized and easy to locate, Canadian filers do tend to err on the side of providing more, rather than less, information – even if the information is less standardized and harder to locate. For example, the disclosure of risk requirement associated with Item 7A of the annual 10-K filing for US filers given in Item 305 of SEC Reg. SK requires companies to use one or more of the three risk disclosure alternatives: sensitivity analysis, tabular, and VaR. Where a particular risk is not material, companies can elect not to provide a risk measurement. Canadian companies have more latitude. In this vein, in the MD&A discussion for the 2010 annual report, Barrick identifies the general *enterprise risk management* approach to risk management:

Enterprise Risk Management

As our Board recognizes that *creating shareholder value is the reward for taking and accepting risk, our primary objective is to maximize long-term value for our shareholders*. Our enterprise risk management vision is to implement a company-wide culture of risk management where risks are promptly identified, assessed, reported, and monitored at all levels of the organization through the use of simple and effective risk management processes. Actively managing risks improves our ability to effectively execute on our business strategy and thereby create shareholder value by finding, acquiring, developing and producing quality reserves in a safe, profitable and socially responsible manner. Consequently, we have established a process for identifying, evaluating and managing company-wide risks. These risks are ranked and prioritized and effective and efficient action plans are developed as necessary. Analysis is also performed to ensure there is proper assessment of risks that may interfere with achieving the strategic objectives of the Company as a whole (Barrick 2010 Annual Report, p.46, emphasis added).

This is followed by a discussion that identifies the key risk facing the company. The first such risk is self-evident and of interest, given the past track record for Barrick gold hedging,:

Exposure to the price of gold

“Barrick’s revenues are primarily derived from the sale of gold and the market price of gold can fluctuate widely due to macroeconomic factors that are beyond our control. Consequently, the market price of gold is one of the most significant factors in determining the profitability of our operations. All of our future gold production is unhedged, providing full leverage to changes in the market gold price. To maximize our realized gold price, we have a corporate treasury function which monitors the gold market and is responsible for our gold sales”.

Significantly, Barrick follows this with a discussion of other significant risks which does *not* include foreign currency exchange rates; interest rate risks; diesel fuel; and, the price risks associated with byproduct minerals, mostly silver and copper. Instead, the enterprise wide risk management at Barrick identifies three other sources of risk: re-licensing risk; project development risk; and, global economic conditions. On these items, the Barrick Annual Report for 2010 identifies re-licensing risk with more traditional risk management concerns in mining:

Re-licensing risk

“Maintaining our social license to operate is critical for Barrick to operate our existing mines and develop our projects around the world. Some of the risks to our social license include: ***compliance with environmental laws and regulations; community relations and human rights issues; and the health and safety of our employees.*** To manage these risks and maintain our social license, we have developed global environmental standards which, in many cases, exceed regulatory requirements and represent industry best practice. We have a globally coordinated community relations strategy that utilizes our corporate and local expertise to improve relations in the communities in which we operate. We have recently joined the Voluntary Principles on Security and Human Rights and are undertaking two new corporate social responsibility (“CSR”) initiatives to further strengthen our CSR performance. ... Additionally, we have an extensive Safety and Health program, committed to the protection of our employees and the residents of communities in proximity to our operations”.

The enterprise risk management solution for re-licensing risk is focussed on expanding the corporate social responsibility profile of Barrick gold.

Another element of traditional risk management in mining is a concern with project development risk:

Project development risk

“The development of our significant capital projects represents a key driver to our plans for future growth. The process to bring these projects into operation may be subject to unexpected delays that could increase the cost of development and the ultimate operating cost of the relevant project. Our Capital Projects group is responsible for completing relevant studies, obtaining the necessary approvals and managing construction. We utilize a formal system to govern advancement of projects as they progress from scoping through the execution and commissioning stages.”

Finally, in the discussion of global economic conditions, the present elements of Barrick commodity risk management activities is identified

Global economic conditions

“Barrick’s operating results and financial condition depend significantly on commodity prices and foreign exchange rates, which are largely dependent on worldwide economic conditions. ***Changes in general economic conditions could result in: adverse changes in key input commodity prices; adverse changes in foreign exchange rates, disruption in financial and credit markets; and negative impacts on our supply chain.*** To manage these risks, we actively hedge foreign exchange economic risks and key input commodities, including the fuel hedge provided by Barrick Energy. We continuously monitor the credit markets as part of our capital allocation function and will seek to minimize disruption to our liquidity or our supply chain to ensure the optimal operation of the Company”. (p.47, emphasis added)

As it turns out, Barrick is still an active hedger of commodity risk associated with commodity inputs, interest rates and foreign exchange rates.

Barrick Hedging Strategy 2010

As summary of the financial instrument held by Barrick and the associated risks is given in Figure 1.B.f. According to the Barrick 2010 annual report, “the primary objective of our risk management program is to mitigate variability associated with changing market values related to the hedged item”.

INSERT Fig. 1.B.f Summary of Financial Instruments
 Insert Figure 1.B.g Barrick Currency Hedges
 Figure 1.B.h- Summary of Derivatives at September, 30, 2011
 Insert Figure 1.B.j *Fair Value of Derivatives*
 Insert Figure 1.B.k Cash Flow on Hedges
 Insert Figure 1.B.L *Gains(Losses) on hedge derivatives*

Comparing Fig. 1.B.a with Figures 1.B.h, 1.B.j, 1.B.k and 1.B.L it is apparent that the financial impact of hedging activity is small relative to the scope of the production, profit and revenue profile of Barrick Gold. Given this, regarding interest rate risks, according to the ABX 2010 annual report, Barrick currently hedges against interest rate risk associated with an outstanding \$ 200 million USD borrowing ‘hedged’ with an interest rate swap (see figure 1.B.f). Exposure to interest rates is described as:

At present, our interest rate exposure mainly relates to interest receipts on our cash balances (\$4.0 billion at the end of the year); the mark-to-market value of derivative instruments; the fair value and ongoing payments under US dollar interest-rate swaps; and to the interest payments on our variable-rate debt (\$1.0 billion at December 31, 2010). Currently, the amount of interest expense recorded in our consolidated statement of income is not materially impacted by changes in interest rates, because the majority of debt was issued at fixed interest rates.

Similarly, for FX rates Barrick states (see Figure 1.B.g):

Currently, Barrick has foreign currency contracts for non-US expenditures, in total of \$4,488 million AUD, \$364 million CAD, 211 billion CLP and 35 million EUR . These are designated as cash flow hedges of anticipated operating, administrative, sustaining capital and project capital spend.

Significantly, Barrick reports financial results in US\$ (not C\$). As illustrated in Figure 1.B.g, Barrick hedges a significant amount of expected currency risk. Barrick describes the general risk

as:

About 60% of our consolidated production costs are denominated in US dollars and are not exposed to fluctuations in US dollar exchange rates. For the remaining portion, our currency hedge position allows for more accurate forecasting of our anticipated expenditures in US dollar terms and mitigates our exposure to volatility in the US dollar.

The rationales for hedging currency exposure are identified as reduced US\$ volatility for expected operating and capital expenditures in that currency during the hedge period. For the two largest FX positions, the A\$ and C\$, Barrick reports:

Total expected Australian and Canadian operating and capital expenditures in 2011 are expected to be AUD \$1,776 million and CAD \$477 million, and as a result we are approximately 92% and 74% hedged, respectively. In addition, we have hedged approximately 84%, 72%, and 46% of our total expected 2012, 2013, and 2014 Australian dollar expenditures at average rates of \$0.75, \$0.72, and \$0.75, respectively.

Barrick also observes that the currency hedging strategy has produced positive results:

Our currency hedge position has provided benefits to us in the form of hedge gains recorded within our operating costs when contract exchange rates are compared to prevailing market exchange rates as follows: 2010 – \$146 million; 2009 – \$27 million; and 2008 – \$106 million. For 2010, we also recorded currency hedge gains in our corporate administration costs of \$33 million (2009 – \$7 million loss and 2008 – \$11 million gain).

While Barrick seeks full gold price risk exposure, at the same time Barrick hedges commodity inputs such as diesel, electricity, propane and natural gas, as well as its production outputs for both copper and silver. Regarding diesel fuel: “On average we consume approximately 3.8 million barrels of diesel fuel annually across all our mines. Diesel fuel is refined from crude oil and is therefore subject to the same price volatility affecting crude oil prices.” The hedging strategy for diesel fuel is described as:

“Volatility in crude prices has a significant direct and indirect impact on our production costs. To mitigate this volatility, we employ a strategy of combining the use of financial contracts and our production from Barrick Energy to effectively hedge our exposure to high oil prices. We currently have financial contracts in place totaling 4.7 million barrels, which represents 56% of our total estimated direct consumption in 2011 and 34% of our total estimated direct consumption over the following two years. Those contracts are primarily designated for our Nevada-based mines, and have average prices below current forward prices. In 2010, we recorded hedge losses in earnings of approximately \$28 million on our fuel hedge positions (2009: \$97 million loss; 2008: \$33 million gain). Assuming market rates at the December 31, 2010 level of \$91 per barrel, we expect to realize hedge gains of approximately \$20 million in 2011 from our financial fuel contracts.”

To this hedge and other energy related expenses, Barrick was engaged in the following:

During the year, we entered into 480 thousand barrels of WTI/ ULSD crack spread swaps, 1,222 thousand barrels of MOPS forwards, 228 thousand barrels of WTB forwards, 228 thousand barrels of JET forwards, and 19 million gallons of propane designated against forecasted fuel purchases for expected consumption at our mines. The designated contracts act as a hedge against variability in market prices on the cost of future fuel purchases over the next four years.

In addition, it is also recognized that “Barrick Energy provides a natural economic hedge against our fuel price exposure”, even though Barrick Energy is not a significant component of Barrick Gold performance (see Fig. 1.B.a). In sum: “The Barrick Energy contribution, along with our financial fuel hedges, provides hedge protection for approximately 92% of our estimated fuel consumption for 2011.”

In addition to input risks, Barrick does have an non-incidental exposure to copper prices. Unlike the handling of gold price, Barrick does hedge copper price exposure using a collar strategy:

“Utilizing option collar strategies, we have put in place floor protection on approximately 60% of our expected copper production for 2011 at an average floor price of \$3.00 per pound. In addition, we have sold net call options on approximately 70% of our 2011 production at an average price of approximately \$4.85 per pound. Our realized price on all 2011 production is expected to be reduced by approximately \$0.12 per pound in 2011 as a result of the net premium paid on option hedging strategies. Our remaining copper production is subject to market prices”.

In this case, the cost of downside protection is partially offset by having a larger volume of copper associated with the ceiling than with the floor. However, the ceiling is further out of the money than the floor resulting in a net collar expense, i.e., the hedge is not constructed as a ‘costless collar’ commonly observed in oil and gas producer hedging strategies.

Silver production is incidental to Barrick gold operations. More precisely, “Silver prices have a significant impact on the overall economics and expected gold total cash costs for our Pascua-Lama project, which is currently in the construction phase. Silver prices do not significantly impact our current operating earnings, cash flows or gold total cash costs. “ Given, there are two items of interest in the Barrick treatment of commodity risk management of silver. The first concerns the hedging method used:

“In the fourth quarter, utilizing zero-cost option collar strategies, we took advantage of high spot silver prices and attractive option pricing by adding hedge protection on three million ounces per year of expected silver production from 2013 to 2017, inclusive, with a floor price of \$20 per ounce and an average ceiling price of \$55 per ounce.”

Presumably, by taking advantage of ‘high’ silver spot prices, Barrick is not averse to selective hedging. Another interesting commodity risk management feature is the agreement reached with

Silver Wheaton:

“In 2009, we entered into a transaction with Silver Wheaton Corp. (“Silver Wheaton”) whereby we sold 25% of the life-of-mine Pascua-Lama silver production from the later of January 1, 2014 or completion of project construction, and 100% of silver production from the Lagunas Norte, Pierina and Veladero mines until that time. Silver Wheaton will make up front payments totalling \$625 million (\$350 million received as at December 31, 2010). Silver Wheaton will also make ongoing payments of \$3.90 per ounce in cash (subject to a 1% annual inflation adjustment starting three years after completing construction at Pascua-Lama) for each ounce of silver delivered under the agreement.”

In effect, by selling rights to silver production for life-of-the-mine, Barrick is engaged in a long-dated OTC, forward contract with option features.

C. Large Mining Conglomerates: BHP Billiton

Unlike Barrick which seeks to be a relatively pure gold mining play, BHP is global mining and oil and gas conglomerate. In 2001, BHP Limited and Billiton Plc merged to form BHP Billiton, which is now the world’s largest mining company measured by total revenue. Furthermore, BHP Billiton is the world’s third largest mining company in terms of market capitalization. BHP Billiton is a dual listed company that consists of BHP Billiton limited (formerly BHP limited) and BHP Billiton Plc (formerly Billiton Plc). The headquarters of the combined BHP Billiton and BHP Billiton Limited are located in Melbourne, Australia. The headquarters of BHP Billiton Plc is located in London, England. Both companies have identical directors and management team. Shareholders in both companies have identical voting rights. BHP Billiton is an immense operation that has 9 business segments, which are petroleum, aluminum, base metals (including uranium), diamonds & specialty products, stainless steel materials, iron ore, manganese, energy coal, and metallurgical coal (see Figure 1.C.c). The 3 segments from which BHP currently derives the most revenue are iron ore, base metals, and petroleum (see figure 1.C.a). BHP Billiton has increased its level of iron ore production for eleven consecutive years. See figure 1.C.b for production levels of all BHP Billiton business segments for the last 3 years.

INSERT figure 1.C.a Revenue from business segments for BHP Billiton

INSERT Figure 1.C.b Production Volumes for BHP Billiton

INSERT Fig. 1.C.c BHP Mine Locations

As a reporting Australian entity, certain elements of risk management disclosure are more complete than for US (FCX) and Canadian firms (ABX, CS) previously examined, and in other instances the reporting is less complete. Discussion of risk management objectives and governance is considerably more detailed. Consistent with US reporting practices, a detailed listing of risk factors is given at the beginning of the annual report. However, little attention is given to the impact of commodity prices. The leading risk identified is: “Failure to discover new reserves, maintain or

enhance existing reserves or develop new operations could negatively affect our future results and financial condition.” In contrast, consider the attention to governance given in the general description of Group risk management in BHP Billiton’s 2011 annual report:

Risk management

We believe that the identification and management of risk is central to achieving the corporate objective of delivering long-term value to shareholders. Each year, the Board reviews and considers the risk profile for the whole business. This risk profile covers both operational and strategic risks. The Board has delegated the oversight of risk management to the Risk and Audit Committee. In addition, the Board specifically requires the CEO to implement a system of control for identifying and managing risk. The Directors, through the Risk and Audit Committee, review the systems that have been established for this purpose and regularly review their effectiveness.

Figures 1.C.d and 1.C.e describe the risk management methods and risk governance structure of BHP. Significantly, accountability for risk management activities lies at the Group Management committee and related sub-committees which report to the CEO and, through the CEO, to the Board of Directors. This is in contrast to alternative risk management structures that make risk management a subcommittee of the Board with the CEO as a member, reporting directly to the Board.

INSERT Fig. 1.C.d BHP Risk Management Methods

INSERT Fig. 1.C.e BHP Governance Structure

Another significant aspect of Fig. 1.C.d is the explicit use of CFaR and VaR methods to measure risk. Precisely how the CFaR methodology is employed and critical values obtained is not discussed. Rather, a general discussion of the methodology is provided:

“A Cash Flow at Risk (CFaR) framework is used to measure the aggregate and diversified impact of financial risks upon the Group’s financial targets. The principal measurement of risk is CFaR measured on a portfolio basis – which is defined as the worst expected loss relative to projected business plan cash flows over a one-year horizon under normal market conditions at a confidence level of 95 per cent. The CFaR framework includes Board-approved limits on the quantum of the CFaR relative to the Group’s financial targets.”

Describing the risk management methods employed, BHP observes: “In executing the strategy, financial instruments are potentially employed in three distinct but related activities”. These activities are outlined in Fig. 1.C.d as: risk mitigation; economic hedging; and, strategic transactions to benefit from market mis-pricing.

BHP provides a conventional classification of risks into: market risk, liquidity risk and credit risk:

“The financial risks arising from the Group’s operations comprise market, liquidity and credit risk. These risks arise in the normal course of business, and the Group manages its

exposure to them in accordance with the Group's Portfolio Risk Management Strategy. The objective of the strategy is to support the delivery of the Group's financial targets while protecting its future financial security and flexibility by taking advantage of the natural diversification provided by the scale, diversity and flexibility of the Group's operations and activities."

Of these risk, the most important to firm performance is market risk. BHP describes market risk as:

"The Group's activities expose it to market risks associated with movements in interest rates, foreign currencies and commodity prices. Under the strategy outlined above, the Group seeks to achieve financing costs, currency impacts, input costs and commodity prices on a floating or index basis. This strategy gives rise to a risk of variability in earnings which is measured under the CFaR framework".

The most revealing statement regarding market risk is the following:

"BHP Billiton manages risk using portfolio risk management strategies and it operates within the overall cash flow at risk (CFaR) limits imposed by the board of directors. ***BHP does not actively engage in currency and commodity hedging because it believe that this provides no long-term benefits to its shareholders.*** Instead BHP employs a financial risk management strategy that incorporates three distinct activities" (emphasis added).

In effect, BHP does not ***actively*** hedge commodity price or currency risk because it has a view that such activities do not add value for shareholders.

BHP Commodity Price Risk Management

The key statement for interpreting the BHP use of commodity risk management is the following:

"Contracts for the sale and physical delivery of commodities are executed whenever possible on a pricing basis intended to achieve a relevant index target. Where pricing terms deviate from the index, derivative commodity contracts are used when available to return realised prices to the index. ***Contracts for the physical delivery of commodities are not typically financial instruments and are carried in the balance sheet at cost (typically at nil); they are therefore excluded from the fair value and sensitivity tables below. Accordingly, the financial instrument exposures set out in the figures below do not represent all of the commodity price risks managed according to the Group's objectives.*** Movements in the fair value of contracts included in the tables below are offset by movements in the fair value of the physical contracts, however only the former movement is recognised in the Group's income statement prior to settlement. The risk associated with commodity prices is managed as part of the Portfolio Risk Management Strategy and within the overall CFaR limit".

The relevance of omitting of contracts for physical delivery from reporting of commodity risk

management activities is apparent in the process used for pricing iron ore, the largest commodity produced by BHP. Together with Vale and Rio Tinto, BHP controls about two-thirds of the seaborne trade in iron ore. Until the first half of 2010, for about four decades iron ore was priced using fixed price contracts that were set on an annual basis.² In 2010, led by the vocal campaign of BHP Billiton CEO Marius Kloppers, the pricing window for selling iron ore to China, the largest consumer of iron ore, was changed to quarterly using observed market price indexes from the month prior to the beginning of a new quarter. Market reports indicate that BHP, reacting to observed discrepancies between spot prices and the quarterly price settings, may have moved during 2011 to monthly and spot pricing on some iron ore contracts. These activities, which are fundamentally related to commodity risk management, are not examined in the commodity price risk management part of the Annual Report.

The commodity price risk reporting that is available is described as follows in Fig. 1.C.d:

“Financial instruments with commodity price risk included in the following tables are those entered into for the following activities:

- Economic hedging of prices realised on commodity contracts as described above
- Purchases and sales of physical contracts that can be cash-settled
- Derivatives embedded within other supply contracts

All such instruments are carried in the balance sheet at fair value”.

Insert Figure 1.C.f Commodity Derivative Contracts

INSERT Figure 1.C.g Commodity Price Exposure

The handling of items not reflected in Figure 1.C.f is described as:

“Not included in the above tables are provisionally priced sales volumes for which price finalisation, referenced to the relevant index, is outstanding at balance date. Provisional pricing mechanisms embedded within these sales arrangements have the character of a commodity derivative and are carried at fair value as part of trade receivables. The Group’s exposure at 30 June 2011 to the impact of movements in commodity prices upon provisionally invoiced sales volumes is set out in the following table”.

This, presumably, includes the reporting for iron ore and other commodity contracts that “involve physical delivery”. Based on Fig. 1.C.f, sensitivity analysis for these commodity price exposures are reported in Fig. 1.C.g. The calculation of these exposures is described as:

“The sensitivities in the above tables have been determined as the absolute impact on fair value of a 10 per cent increase in commodity prices at each reporting date, while holding all other variables, including foreign currency and exchange rates, constant. The relationship between commodity prices and foreign currencies is complex and movements in foreign exchange can impact commodity prices. The sensitivities should therefore be used with care”.

Given the method of determining items that are considered relevant for ‘commodity risk management’, the items identified in Figures 1.C.f and 1.C.g are small compared to the overall scope of BHP corporate activities as illustrated in Fig. 1.C.h which details the cash from operations for BHP.

INSERT Fig. 1.C.h BHP Cash from Operating Activities

Currency and Country risk

BHP is an immense mining corporation with operations spread throughout the world. This creates a significant foreign exchange risk management situation. BHP uses the US dollar as the unit of account. To address the associated currency risk, BHP identifies two distinct types of exposures:

“BHP Billiton is exposed to exchange rate transaction risk on foreign currency sales and purchases. It faces *translational* exposure in respect of non-functional currency monetary items and *transactional* exposure in respect of non-functional currency expenditure and revenues”

Of these two exposures, transactional exposure is an incidental accounting item. The associated translational exposure is given in Figure 1.C.j. BHP describes the item as: “Monetary items, including financial assets and liabilities, denominated in currencies other than the functional currency of an operation are periodically restated to US dollar equivalents, and the associated gain or loss is taken to the income statement.”

Insert figures 1.C.j Translation Risk

INSERT Fig. 1.C.k BHP Location of Customer Revenue

INSERT Figure 1.C.L- Interest rate swaps

Other than conventional depletion, exploration and project development risks associated with mining, the key element in the strategic risk of BHP appears as the second item in the list of risk factors identified in the 2011 Annual Report:

Reduction in Chinese demand may negatively impact our results. The Chinese market has become a significant source of global demand for commodities. In CY2010, China represented 59 per cent of global seaborne iron ore demand, 39 per cent of copper demand, 38 per cent of nickel demand, 41 per cent of aluminium demand, 42 per cent of energy coal demand and 10 per cent of oil demand. China’s demand for these commodities has been driving global materials demand over the past decade.

The central importance to BHP of the Asian commodities market, in general, and the China trade, in particular, is given in Fig. 1.C.k. By moving to monthly and, possibly, daily price settings for iron ore and other commodities, BHP is increasing, not decreasing, exposure to commodity price risk associated with Chinese consumers. Given the vagaries of Chinese demand, there is a considerable

amount of true uncertainty associated with possible future outcomes for essential commodity prices.

Financial risks

Consistent with conventional financial risk management, BHP identifies and discusses separately and in some detail liquidity risk, credit risk and interest rate risk (see figure 1.C.d).

“BHP Billiton is exposed to interest rate risk on its outstanding borrowings and investments from the possibility that changes in interest rates will affect future cash flows or the fair value of fixed interest rate financial instruments. BHP Billiton enters into interest rate swaps and cross currency interest rate swaps to convert most of the centrally managed debt into US dollar floating interest rate exposures”.

Given a strong corporate financial position, BHP is able to access the long term fixed rate debt market and achieve a variable interest rate expense gain by doing fixed to floating interest rate swaps. In addition, BHP describes liquidity risk as:

“Liquidity risk for BHP Billiton arises from the possibility that it may not be able to settle or meet its obligations as they come due. Additionally, liquidity risk arises on debt related derivatives due to the possibility that a market for derivatives might not exist in some circumstances. However, Moodys Investors service has long-term credit rating of A1 for BHP Billiton and Standard & Poors has a long-term credit rating of A+ for BHP Bulliton”.

In effect, BHP views strength of credit rating and the associated ability to access short term borrowing as the solution to liquidity risk. The possibility of liquidity considerations impacting the ability of customers to make contracted payments is not considered relevant enough to mention.

3.2 Canadian Oil and Gas Exploration and Development

A. Oil Sands Miners: Canadian Oil Sands

“Canadian Oil Sands prefers to remain un-hedged on crude oil prices; however, during periods of significant capital spending and financing requirements, management has in the past, and may again, hedge prices and exchange rates to reduce revenue and cash flow volatility to the Corporation. Canadian Oil Sands did not have any crude oil price hedges in place for 2010 or 2009. Instead, a strong balance sheet was used to mitigate the risk around crude oil price movements. As at February 23, 2011, and based on current expectations, the Corporation remains un-hedged on its crude oil price exposure.”

Canadian Oil Sands, *Annual Report* (2010)

Company Description

Though the Syncrude consortium was formed in 1964, the history of Canadian Oil Sands Limited is more recent. The company began operation on Nov. 30, 1995 when an operating subsidiary, Athabasca Oil Sands Investment Inc., acquired an 11.74% interest in the Syncrude project. On June 26, 1996 the company's other operating subsidiary, Canadian Oil Sands Investments Inc., acquired a 10% interest in Syncrude from Pan-Canadian Petroleum Limited. In a one-for-one exchange of units, on July 5, 2001 these two subsidiaries were merged into the single entity Canadian Oil Sands Limited (COS) which then held 21.74% of Syncrude.³ Shortly thereafter, the current President and CEO of COS, Marcel Coutu, was appointed by the board of directors. Prior to this, Coutu had accumulated over 20+ years of oil industry experience, though little of this experience had been at the senior executive level. Coutu came to COS after a two year stint as CFO at Gulf Canada which was taken over by Conoco just prior to his departure. Prior to being at Gulf Coutu worked at Trans-Canada Pipelines (TRP) where he attained a position at the head of the international unit. In February 2003, COSL successfully completed the purchase of an additional 10% of the Syncrude project from EnCana with an option to buy EnCana's remaining 5% share which was subsequently exercised. Coutu is still the CEO and public face of COS.

COS was initially organized as a unit trust but, as a result of a change in federal tax policy, converted back to a corporation on Dec. 31, 2010. One shortcoming of the unit trust structure often identified by critics was the weak management and governance structures of such entities. Whether this is the case at COS, which is effectively a non-operating company, is unclear. In addition to Coutu, the management team at COS is relatively small. Given that the activities of COS are not directly involved with the production of oil at Syncrude, this is not surprising. However, the management of COS does have significant activities that relate primarily to the running of the trust and in the marketing of SCO. There is a Chief Operations Officer on staff with extensive knowledge of bitumen mining and heavy oil upgrading operations. The implementation of administrative and general management activities for the trust within COS began in 2002. Prior to this time, this aspect of COS operations was conducted under an Administrative Services Agreement with EnCana (and its predecessors). While moving these activities within COS did result in some cost savings to unit holders, the demand on management was such that: "In 2006 Syncrude Canada Ltd. entered a Management Services Agreement with Imperial Oil Resources. It provides Syncrude with operational, technical and business management services" (COS Annual Report 2008). The responsibility for the marketing of SCO by COS stems from the Syncrude joint venture partnership agreement where Syncrude is responsible for delivering SCO to each consortium member 'at the plant gate'.

Being initially organized as a unit trust, the impact that the management of COS had on the income that was generated for unit holders came largely through participation in shaping the development of the Syncrude project. The passive character of the business was well suited to the classical unit trust, making it difficult for trust management to expand the underlying business with available resources due to a stated desire to payout a significant portion of operating cash flow net of capital expenditures. While there was some scope for oil and gas royalty trusts to issue units or use cash flow to purchase additional properties to offset depletion in current properties, the legal intention of the trust structure was that trusts would be passive investors. As the trust sector expanded, especially into business trusts, the notion of passive management was increasingly ignored. Corporate tax and other advantages associated with unit trust issues meant such securities sold at a premium relative

to common stock of comparable non-trust corporations. As such, business trusts were able to use this advantage to takeover other corporations and capture the premium associated with moving the real assets to trust tax status. This contributed to an increasing trend toward unit trusts absorbing non-trusts, contributing to the further erosion of the corporate tax base and, in 2006, led to the federal government eliminating favorable tax treatment of trust income for all but the REIT sector.

INSERT Fig. 2.A.a COS Summary of Quarterly Results 2009-2011

Ultimately, valuation of COS depends on the value of the Syncrude project (see Fig. 2.A.a). Understanding this valuation depends on a detailed understanding of the mining and oil extraction technology that is being used at the Syncrude leaseholds. The eight leases involved cover 102,160 hectares making Syncrude the largest leaseholder of Alberta's surface oil sands deposits and, together with Suncor, holder of the leases with the highest concentrations of bitumen. Because Syncrude is a bitumen mining project, the actual size of the bitumen reserve on these leaseholds cannot be subjected to conventional methods of reserve estimation. In addition, the recovery of SCO from the bitumen is much higher than for conventional well bore production. Because the resource is being mined, substantially more of the sweet crude oil contained in the bitumen is recovered. Approximately 85% of the bitumen recovered from the slurring process is used to produce SCO which is a low sulphur, high quality light crude that trades at a premium to WTI due to the higher potential refinery yield of more expensive byproducts, especially gasoline. Being a light crude, SCO is easier to ship by pipeline than heavy crude and the lower sulphur content makes SCO attractive to refineries concerned about sulphur dioxide emissions.⁴

INSERT Fig. 2.A.b COS Highlights 2008-2009

INSERT Fig. 2.A.c COS Highlights 2008Q1 + 2009Q1

Commodity and Financial Risk Management

“There are a number of risks that could impact Canadian Oil Sands’ net income and cash from operating activities and, therefore, the dividends ultimately paid to Shareholders. Cash from operating activities is highly sensitive to a number of factors including: Syncrude production; sales volumes; oil and natural gas prices; price differentials; foreign currency exchange rates; operating, administrative, and financing expenses; non-production costs; Crown royalties; and regulatory and environmental risks. Dividends may also be impacted by Canadian Oil Sands’ financing requirements for capital expenditures.”

COS Annual Report (2010, p.33)

Implications of the COS no-hedging policy appear from comparing results for 2010-2011 with 2008-2009. Comparing 2008Q1 with 2009Q1 is particularly compelling. There were considerable cash costs to shareholders from the management decision to not lock in the higher prices that prevailed during 2007-2008, or buying downside protection with puts. In addition to the no-hedging policy for the oil price, COS provides the following statement about hedging of natural gas, an important commodity input to production of SCO:

Purchased natural gas is a significant component of the bitumen production and upgrading processes. Increases in natural gas prices, therefore, introduce the risk of higher operating costs. Similar to crude oil prices, monthly average AECO natural gas prices have experienced significant movements over the last three years, ranging from a high of \$11.15 per GJ to a low of \$1.92 per GJ. To the extent crude oil and natural gas prices move together, the risk of natural gas price increases is mitigated, as the Corporation is significantly more levered to oil price increases. The main risk involves a de-linking of crude oil and natural gas price movements. The Corporation has previously used hedge positions to mitigate natural gas price risk and will continue to assess this strategy as a means to manage short-term operating costs. No natural gas price hedges were utilized in 2010 or 2009 and as at February 23, 2011, there were no natural gas price hedges in place.

The no-hedging policy for outputs is also applied to commodity inputs. Fortunately for COS, the “de-linking of crude oil and natural gas price movements” has worked to the advantage of COS due to natural gas prices falling both absolutely and relative to crude oil prices.

INSERT Figure 2.A.d COS Sensitivity Analysis, 2009

INSERT Figure 2.A.e COS Sensitivity, 2011

In addition to important a no-hedging policy for commodity inputs and outputs, the no-hedging policy extends to currency hedging:

In the past, the Corporation has hedged foreign currency exchange rates by entering into fixed rate currency contracts. The Corporation did not have any foreign currency hedges in place during the first nine months of 2011 or 2010, and does not currently intend to enter into any new currency hedge positions. The Corporation may, however, hedge foreign currency exchange rates in the future, depending on the business environment and growth opportunities.

What COS does do is to finance \$1.275 billion in long term debt in US dollars which provides a significant partial natural hedge when compared to the just over \$7 billion book value of assets:

Our revenue exposure [to changes in the US to Canadian dollar exchange rate] is partially offset by U.S. dollar obligations, such as interest costs on U.S. dollar denominated long-term debt (Senior Notes) and our share of Syncrude’s U.S. dollar vendor payments. In addition, when our U.S. dollar Senior Notes mature, we have exposure to U.S. dollar exchange rates on the principal repayment of the notes. This repayment of U.S. dollar debt acts as a partial economic hedge against the U.S. dollar denominated revenue payments we receive from our customers.

Similarly, for interest rate risk management COS reports:

Canadian Oil Sands’ net income and cash flow from operations are impacted by U.S. and

Canadian interest rate changes because our credit facilities and investments are exposed to floating interest rates. In addition, we are exposed to the refinancing of maturing long-term debt at prevailing interest rates. As at September 30, 2011, there were no amounts drawn on the credit facilities ... and the next long-term debt maturity is in August 2013. The Corporation did not have a significant exposure to interest rate risk based on the amount of floating rate debt or investments outstanding during the quarter.

In addition to having no foreign currency transaction hedges, COS does not have “a significant exposure to interest rate risk”. Following Emm et al. (2007), COS provides sensitivity analysis for measuring risk exposure (see Figure 2.A.d and 2.A.e). COS does engage in two substantive risk management practices. For credit risk: “Canadian Oil Sands carries credit insurance to help mitigate a portion of the impact should a loss occur and continues to transact primarily with investment grade customers.”

B. Enhanced Oil and Gas Exploration: Penn West Exploration

"Penn West considers price hedging of oil and natural gas production to be a useful tool of risk management. Its uses include protecting planned capital budgets, safeguarding the economics of acquisitions and providing downside cash flow protection to support planned distributions."

Penn West, *Annual Report* (2010)

Company Overview

Penn West Exploration is based in Calgary, Alberta with operations in North East BC, Central Alberta, Southern Saskatchewan, and Manitoba. In 2011, Penn West output was 63 % oil and 37 % natural gas (see figure 2.B.a). Prior to conversion from an income trust to petroleum exploration and development company in Jan. 2011, Penn West Exploration operated under the trade name Penn West Petroleum. Penn West Capital Focus for 2011 was concentrated almost exclusively in ***enhanced oil recovery*** the Western Sedimentary Basin (see Figure 2.B.b). As indicated in the operating cost of production per barrel of over C\$15, the company has a somewhat higher cost of production than other Canadian oil and gas producers operating in the Western Sedimentary Basin such as Crescent Point Energy Corp. at about C\$11 per barrel for light oil obtained mostly by drilling for new deposits and Canadian Natural Resources at about \$12 per barrel for mostly Canadian heavy oil production. Penn West describes the overall business as:

“Penn West's assets include ownership within many of the largest pools discovered in western Canada. The majority of the resources-in-place are not extractable using conventional primary production methods. The future opportunities are increasingly coming through the application of various enhanced recovery techniques to access and produce more of the resource. This is a major focus for Penn West. The elements of the enhanced recovery

strategy include:

- Enhancing, improving and enlarging water flood programs already in operation at many oil pools;
- Evaluating, piloting and commercially implementing enhanced recovery methods such as carbon dioxide (CO₂) miscible flood and cyclic steam stimulation; and
- Applying emerging technologies to work existing assets in new ways in order to unlock a challenging reservoir and/or improve extraction economics.”

Insert figure 2.B.a Composition of Penn West production

Insert figure 2.B.b Penn West 2011 Capital Expenditure Focus

Insert figure 2.B.c Penn West Working Reserves

As illustrated in Figures 2.B.b and 2.B.c, Penn West is an exploration and development company that needs to fund on-going capital expenditures to replace depleting fields:

“A key business objective is to add reserves and production from our existing resource base, thereby creating incremental future cash flows available for reinvestment and distribution to Penn West's investors. The proportion of our capital spending directed towards enhanced oil recovery is planned to be carefully increased as we go forward based on the opportunities that we currently recognize. Although the magnitude of the annual capital commitment is managed in accordance with commodity prices and the capital available for reinvestment, the overall strategy points to growth”.

The 2010 cash flow statement and 2011-Q3 income statement (see Figure 2.B.d and 2.B.e) give an indication of the level of capital expenditures that need to be maintained is well over a billion dollars per year and the size of risk management gains and losses relative to the overall size of the business.

INSERT Fig. 2.B.d Penn West 2010 Cash Flow Statement

INSERT Fig. 2.B.e Penn West 2011-Q3 Income Statement

Hedging Philosophy

Penn West describes the firm hedging policy as:

“Penn West considers price hedging of oil and natural gas production to be a useful tool of risk management. Its uses include protecting planned capital budgets, safeguarding the economics of acquisitions and providing downside cash flow protection to support planned distributions.”

In effect, Penn West identifies three essential elements guiding commodity risk management decisions. In addition to the protection of capital budgets and acquisitions – motivations for hedging often identified in academic studies, e.g., Froot et al. (1993, 1994) – Penn West also identifies the

“downside” protection of distributions by hedging to ensure that capital expenditure commitments do not impinge on cash distributions which, in Jan. 2012 were approximately 5.2% with a common stock price just over C\$20.⁵ The impact of risk management activities on smoothing the prices for crude oil and natural gas for Penn West and on Penn West earnings is given in Figures 2.B.f and 2.B.g.

Insert figure 2.B.f Impact of Risk Management on Pricing
 INSERT Fig. 2.B.g Impact of Unrealized Risk Management Income

Business Risks

A detailed discussion of the key business risks faced by Penn West is included in the Management’s Discussion and Analysis for the year ended December 31, 2010 under the heading “Business Risks” where Penn West provides a conventional identification of business risks facing the firm:

We are exposed to normal market risks inherent in the oil and natural gas business, including, but not limited to, commodity price risk, foreign currency risk, credit risk, interest rate risk, liquidity risk and environmental and climate change risk. We seek to mitigate these risks through various business processes and management controls and from time to time by using financial instruments.

From this conventional listing of risks, Penn West singles out commodity price risk:

Commodity price fluctuations are among our most significant exposures. Crude oil prices are influenced by worldwide factors such as OPEC actions, world supply and demand fundamentals, and geopolitical events. Natural gas prices are influenced by the price of alternative fuel sources such as oil or coal and by North American natural gas supply and demand fundamentals including the levels of industrial activity, weather, storage levels and liquefied natural gas activity.

Specific directives on hedging and an indication of the corporate governance structure for risk management decisions at Penn West are provided:

In accordance with policies approved by our Board of Directors, we may, from time to time, manage these risks through the use of swaps, collars or other financial instruments up to a maximum of 50 percent of forecast sales volumes, net of royalties, for the balance of any current year plus one additional year forward and up to a maximum of 25 percent, net of royalties for one additional year thereafter.

INSERT Fig. 2.B.h Penn West Detailed Hedge Positions, 2010
 INSERT Fig. 2.B.j Penn West Detailed Hedge Positions, Q3 2011

Such Board directives to limit the allowable percentage of output that can be hedged is commonplace across non-financial firms. For example, Canfor Corp., an integrated forest products company headquartered in Vancouver, B.C. has a Board directive to hedge no more the 15% of lumber sales and 5% of pulp sales. Similarly, BC Ferries, the monopoly provider of ferry services in BC, has a Board determined 70% restriction on hedging fuel expenses.

As illustrated in Figures 2.B.h and 2.B.j, Penn West is an active user of derivative security contracting to manage risks associated with the price of crude oil, natural gas, electricity, foreign exchange and borrowing costs. For the commodities, the size of the hedge position does change over time. Observing that Penn West had production of 164,000 barrels of oil equivalent (boe)/day from natural gas, light oil and heavy oil with 80,000 bbls. from light oil, the size of the hedge position for oil appears to hover close to Board determined maximum percentage. Comparison of Fig. 2.B.h and 2.B.j reveals the size of hedge positions do fluctuate through time. For example, consider the situation for natural gas hedges in place reflected in the 2010 annual report:

“In 2010, the AECO Monthly Index averaged \$4.12 per mcf compared to \$4.13 per mcf in 2009. Our corporate average natural gas price before the impact of the realized portion of risk management was \$4.20 per mcf for 2010. We currently have no natural gas risk management contracts for 2011 or beyond.”

Yet, by the end of Q3-2011, Penn West had established a swap hedge for natural gas of 50,000 mcf. Give the weak pricing environment for natural gas, hedging natural gas output at this juncture has considerable justification.

Foreign Currency and Interest Rate Risk

As with other Canadian oil and gas producers, Penn West is exposed to changes in the C\$/US\$ exchange rate. This exposure is described as:

“Prices received for crude oil are referenced to or denominated directly in US dollars, thus our realized oil prices are impacted by Canadian dollar to US dollar exchange rates. A portion of our debt capital is denominated in US dollars, thus the principal and interest payments in Canadian dollars are also impacted by exchange rates. When we consider it appropriate, we may use financial instruments to fix or collar future exchange rates to fix the Canadian dollar equivalent of crude oil revenues or to fix US denominated long-term debt principal repayments.”

Similarly, for interest rate risk Penn West reports:

“At December 31, 2010, we had US dollar denominated debt with a face value of US\$1.2 billion (2009 – US\$0.9 billion) on which the repayment of the principal amount in Canadian dollars was not fixed.”

An the handling of interest rate risk is described as:

“We currently maintain a portion of our debt capital in floating-rate bank facilities which results in exposure to fluctuations in short-term interest rates which remain at lower levels than longer-term rates. From time to time, we may increase the certainty of our future interest rates by entering fixed interest rate debt instruments or by using financial instruments to swap floating interest rates for fixed rates or to collar interest rates. As at December 31, 2010, none of our long-term debt instruments were exposed to changes in short-term interest rates (2009 – 14 percent).

As at December 31, 2010, Penn West had a total of \$1.7 billion of fixed interest rate debt instruments and \$0.3 billion of convertible debentures outstanding. On the fixed interest rate debt the average remaining term was 7.2 years (2009 – 7.7 years) with an average interest rate of 5.7 percent (2009 – 4.6 percent), including the effects of interest rate swaps.

INSERT Figure 2.B.k Penn West Sensitivity Analysis

Finally, Penn West uses sensitivity analysis to provide measurement of exposure to change in oil prices and volumes, natural gas prices and volumes, the US\$/C\$ exchange rate and the level of interest rates. This approach leads to statements such as: “Based on December 31, 2010 pricing, a \$1.00 change in the price per barrel of liquids would change the pre-tax unrealized risk management gain by \$15 million.” In comparison to more sophisticated methods of measuring exposure, the limitations of sensitivity analysis are apparent. No information is provided about the distribution of previous price, rate or volume changes. Sensitivity estimates are, at best, point estimates and take no account of convexities and other non-linearity effects that occur when the variables of interest experience large changes. Only the impact on “funds flow” is considered. Other measures of firm performance are not considered.

C. Mixed Mining and Conventional: Canadian Natural Resources (CNQ)

“The Company uses derivative financial instruments to manage its commodity price, foreign currency, and interest rate exposures. These financial instruments are entered into solely for hedging purposes and are not used for speculative purposes.”

Canadian Natural Resources, *Annual Report* (2010)

Company Overview

Canadian Natural Resources Limited is headquartered in Calgary, Alberta with operations in western Canada, the North Sea off Scotland, and West Africa. The independent company has grown rapidly since 1989 when production was approximately 1400 boe per day. At the end of 2010, the company had 4671 employees of which 371 were employed in the international segment of the business. In 2010, combining crude and natural gas production, the company produced 643,000 boe per day (see Figures 2.C.a and 2.C.b) of which 425,000 bbls./day were due to crude oil production.

The bulk of this production is located in North America, with about 20% in light oil, 35% in heavy oil and bitumen and 14% from the Horizon oil sands mining and upgrading project. For each type, costs of production are well below the selling prices. With initial construction beginning in 2005 and expected production startup in mid-2010, due to production interruptions since the project came on-stream, the Horizon project is yet to deliver a full year at expected production capacity of 200,00 plus bbl./day. While the earlier history of CNQ revolved around conventional light oil and natural gas production, Figure 2.C.c demonstrates that the future productive capacity of CNQ depends fundamentally on bitumen, oil sands mining and in-situ heavy oil deposits.

INSERT Figure 2.C.a CNQ 2010 Corporate Highlights

INSERT Figure 2.C.b

Composition of Production, Before Royalties and Production Expenses

INSERT Figure 2.C.c CNQ Resource Disclosure

The extent of CNQ commercial activities and the relative impact of hedging on the financial results is reflected in the earnings and cash flow statements (see Figures 2.C.d and 2.C.e). While the earnings statement records the net result of realized and unrealized gains and losses from risk management activities, the cash flow statement for CNQ records both. Figure 2.C.f further attributes the realized and unrealized gains and losses to risk management for three categories of hedges: sales of crude oil and natural gas liquids; purchases of natural gas; and, FX and interest rates. The size of the realized and unrealized gains and losses for 2008 and 2009 are remarkably large compared to cash flow from operations or earnings. For example, the unrealized gain in 2008 was almost half the size of cash from operations. The net impact on earnings was about 20% from realized plus unrealized gains and losses in 2008. While 2008 exhibited a dramatic improvement to earnings and cash flow, the bulk of these gains were returned in 2009.

INSERT Figure 2.C.d CNQ Earnings Statement 2010

INSERT Figure 2.C.e CNQ Cash Flow Statement, 2010

Figure 2.C.f CNQ Risk Management Activities, Unrealized and Realized Gains and Losses

Risk Management Activities

Risk management strategies for crude oil sales and natural gas purchase in place on June 2011 and Sept. 2008 are given in Figures 2.C.g and 2.C.h. It was the crude oil positions that generated the bulk of gains and losses from risk management activities during 2008 and 2009. CNQ uses a combination of crude oil price collars and out of the money puts. Such use of multiple risk management strategies can be found in other industries, e.g., Geczy et al. (2006) for natural gas. Comparing the size of the aggregate 225,000 bbl./day collar in 2008-Q3 with the 50,000 bbl./day collar in 2011-Q2, it is apparent that CNQ has substantively reduced both the size and term of the collar position. Whereas collars in 2008 had maturities beyond one year in the future, the 2011-Q2 term is only six months. The size of the out of the money put position has also been reduced, though the 100,000 bbl./day size of the 2011-Q2 position is comparable to the 92,000 bbl./day put with the \$100 exercise price in 2008 that applied to pricing for 2009. The premium cost of maintaining the 2011-Q2 put position is \$27 million per quarter. As illustrated in Fig. 2.C.h, CNQ is not the only

Canadian oil and gas company pursuing a hedging strategy that combines different types of derivative securities. In particular, Crescent Point Energy combines puts, collars and swaps to manage crude oil price risk.

INSERT Figure 2.C.g Canadian Natural Hedging Activity, June 30, 2011

Insert figure 2.C.h CNQ Crude Oil Hedge Positions 2008-Q3

INSERT Figure 2.C.j Crescent Point Energy Corp. Crude Oil Hedge Positions, 2010-Q3

As with other non-financial firms, CNQ provides considerable reporting on risk management associated with FX and borrowing costs (see Fig. 2.C.k and Fig. 2.C.L). In particular, for borrowing costs:

The Company enters into interest rate swap contracts to manage its fixed to floating interest rate mix on certain of its long-term debt. The interest rate swap contracts require the periodic exchange of payments without the exchange of the notional principal amounts on which the payments are based.

The impact of interest rate risk management on the overall performance of CNQ is incidental. The notional amount of the total is relatively small compared to the more than \$10 billion outstanding of long term debt and other long term liabilities.

INSERT Figure 2.C.k CNQ Interest Rate and Cross Currency Swaps, Dec. 2010

INSERT Figure 2.C.L CNQ Sensitivity Analysis

Regarding FX risk management, CNQ observes:

The Company is exposed to foreign currency exchange rate risk in Canada primarily related to its US dollar denominated long-term debt and working capital. The Company is also exposed to foreign currency exchange rate risk on transactions conducted in other currencies in its subsidiaries and in the carrying value of its self-sustaining foreign subsidiaries. The Company periodically enters into cross currency swap contracts and foreign currency forward contracts to manage known currency exposure on US dollar denominated long-term debt and working capital.

To handle currency exposure on long-term US\$ borrowing, CNQ employ fixed-to-fixed cross-currency swaps:

Cross currency swap contracts are periodically used to manage currency exposure on US dollar denominated long-term debt. The cross currency swap contracts require the periodic exchange of payments with the exchange at maturity of notional principal amounts on which the payments are based.

In addition to cross currency swaps, CNQ also employs forward FX contracts for cash management

purposes:

Foreign currency forward contracts are periodically used to manage foreign currency cash management requirements. The foreign currency forward contracts involve the purchase or sale of an agreed upon amount of US dollars at a specified future date at forward exchange rates.

In addition to the cross currency swap contracts in Fig. 2.C.k, at year end 2010, CNQ had US\$1,162 million of foreign currency forward contracts outstanding, with terms of approximately 30 days or less.

The final element of the risk management reporting provided by CNQ is provided by the use of sensitivity analysis to report exposures. As reported by CNQ, the sensitivity analysis in Fig. 2.C.L:

summarizes the annualized sensitivities of the Company's net earnings and other comprehensive income to changes in the fair value of financial instruments outstanding as at December 31, 2010, resulting from changes in the specified variable, with all other variables held constant. These sensitivities are prepared on a different basis than those sensitivities disclosed in the Company's other continuous disclosure documents, and do not represent the impact of a change in the variable on the operating results of the Company taken as a whole. Further, these sensitivities are theoretical, as changes in one variable may contribute to changes in another variable, which may magnify or counteract the sensitivities. In addition, changes in fair value generally can not be extrapolated because the relationship of a change in an assumption to the change in fair value may not be linear.

This considerable listing of difficulties associated with conducting and interpreting conventional sensitivity analysis suggests that an alternative, more revealing, approach to exposure measurement is indicated.

3.3 Airlines and Jet Fuel Hedging

A. Commodity Risk Management for Airlines

“For a company to survive, I believe it is necessary to build an enterprise-wide risk management system, taking into consideration business risks and strategic risks which are not covered by insurance. This requires that employees understand everyday risk management without exception. It is also necessary to take measures for emergency management in the case of risk actualization and other measures based on business continuity planning, which take into consideration large-scale disasters, etc. as such. We are required to develop both a department and appropriate human resources acting as internal checks since it is important to identify risk, assess the impacts and consider the hedge mechanisms. This is a fundamental point of view of risk management, which does not start with an initial insurance perspective.”

Kichisaburo Nomura, Chairman, All Nippon Airways (2003)

The airline industry provides a wealth of information available from academic, industry and government studies. Given the economic importance of the airline industry both domestically and globally, it is not surprising that most academic studies examine issues other than risk management. For example, there are numerous studies on market organization and pricing behavior, e.g., Borenstein (2011), Doganis (2002), Chi and Koo (2009), Cliberto and Williams (2010), Gerardi and Shapiro (2009), Hofer and Ergolu (2010). Some studies focus on pricing dynamics, e.g., Chi and Koo (2009), Cliberto and Williams (2010), while others consider the impact of competition, e.g., Gerardi and Shapiro (2009). There are also other studies that aim to explain the poor performance of the US airline industry since the Airline Deregulation Act (1978). Borenstein (2011, p.233) describes the situation:

The industry lost \$10 billion from 1979 to 1989, made \$5 billion in the 1990s and lost \$54 billion from 2000 to 2009 (all figures in 2009 dollars). To put these figures in context, at the end of 2000, after six consecutive profitable years, the entire book value of US passenger carriers' assets was \$159 billion and shareholder equity was \$40 billion.

Even if the financially disastrous first decade of the 21st century is ignored: “This dismal financial record isn’t what economists, analysts, or industry participants predicted in 1978.”

In addition to studies on the economics of the airline industry as a whole, there are also studies focusing on characteristics that drive business performance for firms within the airline industry, e.g., Busse (2002), Flouris and Walker (2005), Gritta et al. (2006), Malighetti et al. (2011). Government studies and industry studies provide impressive detail on various aspects of individual airline performance. For example, the Bureau of Transportation Statistics in the US provides detailed statistics on airline traffic and financial performance obtained from required regulatory filings (see Fig. 3.A.a and 3.A.b). Other useful information is available from: the Air Transport Association (ATA), the primary association of US airline companies; the International Air Transport Association (IATA), representing some 240 international airlines with 84% of total air traffic; and, the Boeing Corporation which produces a number of useful publications including the Current Market Outlook, 2011-2030.

INSERT Figure 3.A.a US Airlines Revenue Passenger Miles 2011

INSERT Figure 3.A.b US Air Carrier Statistics 2011

In contrast to the considerable information about airline economics and traffic statistics, there are comparatively few studies directly on commodity risk management for airlines. In particular, the increase in the level and volatility of jet fuel prices requires airline companies to be fundamentally concerned with managing the strategic risk associated with jet fuel prices. As such, the strategic need for airlines to manage jet fuel price risk is relatively recent development (see Figure 3.A.c). The upswing in crude oil prices between 2001 and 2008 resulted in jet fuel costs becoming the largest and most volatile component of expenses. As illustrated Figures 3.A.d and 3.A.e, this runup in jet fuel price level and volatility continues, especially when prices are denominated in US\$. Prior to the emergence of this jet fuel risk, labor costs and capital expenditure programs were more central to airline strategy. Financial risk management associated with FX and interest costs were typically more significant than managing jet fuel risk. Against this backdrop, risk management for airlines

also has address fundamental issues associated with catastrophic loss and related security issues.

INSERT Figure 3.A.c Airline Operating Costs, by Region, 2001 and 2008

INSERT Figure 3.A.d Jet Fuel and Crude Oil Prices, 2007-2012

INSERT Figure 3.3.A.e Jet Fuel Prices in US\$ and Euros, 2007-2011

Some studies that do examine risk management for airlines emphasize the disaster element of airline risk management, the need to maintain safety and prevent crashes, e.g., Nomura (2003). The most exhaustive and useful studies directly concerned with commodity risk management in the airline industry are Carter (2006a, b), though Weiss and Maher (2009), Morrell and Swan (2006) and Rao (1999) are also helpful.⁶ Bertus et al. (2009) provide a ‘scientific’ approach to hedge ratio estimation for airlines using the most advanced available econometric techniques to conclude “airlines should hedge their positions in jet fuel using a horizon-sensitive model that directly accounts for movements in the jet fuel, crude oil spread”. Hallerbach and Menkveld (2004) employ a “Component Value at Risk” methodology to examine downside risk assessment and management in the airline industry. Such sources provide a variety of conflicting viewpoints on commodity risk management for airlines.

INSERT Figure 3.A.f Global Commercial Airline Profitability

INSERT Figure 3.A.g EBITDA as a % of Revenues by Region, 2005-2011

Carter et al. (2006a,b) take a strong empirically based stance in favor of hedging jet fuel price risk. Given the dramatically increasing importance of jet fuel costs in airline expenditures (see Fig. 3.A.c) combined with the thin profit margins (see Fig. 3.A.f and 3.A.g), the importance of commodity risk management activities such as hedging is not surprising. The key questions revolve around how to implement and how much risk management is appropriate. Both costless collars and out-of-the-money calls involve insurance solutions whereas swaps, forwards and futures contracts expose the firm to losses from adverse movements on the hedge. There is little information on which approach is appropriate in a particular situation. The airlines examined below -- SIA and Southwest Airlines -- use a combination of strategies. In addition, while hedge ratio estimates from academic studies are typically close to a full hedge, firms in practice tend to hedge substantially less. Some airlines, e.g., SIA, do not always report the exact amount of total fuel purchases that are hedged.

While taking a generally bullish view of airline hedging, the empirical results provided in Carter et al. (2006a,b) do not distinguish between various types of risk management activities. An out-of-the-money call strategy is lumped in with the use of jet fuel swaps. This general overview approach to academic advice on hedging is not restricted to Carter et al. For example, Morrell and Swan (2006, p.729) take an agnostic position on fuel price hedging:

A fuel price hedge would create exceptional value when an airline is on the edge of bankruptcy, but when this occurs an airline does not have the liquidity to buy oil derivatives. On the other hand, hedges probably did make sense when airlines were state-supported, and variable levels of hedging can be useful in transferring profits from one quarter to another. Finally, hedging may be a zero cost signal to investors that management is technically alert and perhaps this is the most compelling argument for airline hedging. However, it lies more

in the realm of the psychology of markets than in the mathematics of economics.

Alternatively, Rao (1999, p.39) is another study in the bullish camp:

after controlling for trend, seasonality, and persistence of shocks, hedging has the potential to reduce the unexplained volatility of the average airline's quarterly income by over 20%. Thus, the results suggest that the usefulness of hedging is not restricted to protecting weak airlines incapable of withstanding an increase in fuel prices. Also, airlines should not eschew hedging merely because of the possibility of incurring opportunity costs if fuel prices go down rather than up; hedging appears to pay off in the long run by providing a more stable earnings stream.

Carter et al. (2006a, p.32-3) provide the following description concerning the value of airline hedging practices:

“Does hedging add value to corporations?” our response is a definite “yes” for the 28 airlines in our sample. Those airlines that hedge their fuel costs have Tobin's Q ratios that are 5-10% higher than those of airlines that choose not to hedge. Our results also suggest that the main source of value added by hedging is its role in preserving the firm's ability to take advantage of investment opportunities that arise when fuel prices are high and airline operating cash flows and values are down. Specifically, we find that the value premium associated with hedging increases with the level of the firm's capital investment.

We also find that the more active hedgers of fuel costs among the airlines are the larger firms with the least debt and highest credit ratings. This result is somewhat surprising, at least to the extent the smaller airlines might be expected to have larger financial distress costs (as a percentage of firm value), and hence greater motive to hedge. One explanation is that the smaller airlines have lacked either sufficient resources or the strategic foresight to acquire a derivatives hedging capability. A second possibility, however—one that is consistent with our main findings—is that the largest airlines also have highest costs of financial distress (even as a percentage of firm value) in the form of more growth opportunities that could be lost as a result of high leverage and financial risk. Conventional wisdom says it is mainly just the largest airlines that are able to buy distressed assets during periods of weak industry cash flows—and to the extent this is so, such firms may also have the most to gain from hedging.

In contrast to views in favor of fuel price hedging, Weiss and Maher (2009, p.362) claim:

Results indicate that operational hedging vehicles (fleet standardization, high-fleet utilization, an aircraft ownership policy rather than leasing, and international operations) are more powerful in protecting firms than using financial instruments. The study contributes in guiding managers as to how operations policy can serve as an imperative factor in mitigating exposures to low-end performance levels.

These operational elements of natural hedging can be used to explain the less than full hedging of fuel price risk that is widespread practice among airline companies.

INSERT Figure 3.A.h Scheduled global passenger traffic, 2001-2011

INSERT Figure 3.A.j Airline Industry Terminology

Academic studies are largely concerned with whether hedging jet fuel is a desirable strategy for airline companies. This is consistent with the general types of questions asked in academic studies of commodity risk management across industries. While somewhat helpful, the types of questions being asked miss the main questions confronting ‘real time’ commodity risk managers, e.g., what are the appropriate methods to use in managing a particular commodity price risk? Airlines are not the only companies in the transportation business that are impacted by jet fuel prices. For example, air cargo companies such as FedEx face similar challenges. Yet, in the FedEx case, jet fuel prices are managed using fuel surcharges built into FedEx billing procedures. Though the fuel surcharge approach has been used at times in the airline industry, this approach poses significant complications when people, not air cargo, are being transported. Another example of the diversity of possible methods for handling fuel price risk appears with railroads where, despite fuel costs being as much as 20% of total expenses, fuel hedging is uncommon. This could be due to the more severe impact of fuel costs on important competitors, such as trucking companies. In turn, major trucking companies, such as Marten Transport, employ partial fuel surcharges to deal with fuel price risk.

B. Global Airlines: Singapore Airlines (SIA)

"Singapore Airlines is a global company dedicated to providing air transportation services of the highest quality and to maximising returns for the benefit of its shareholders and employees"

Singapore Airlines Mission Statement

Company Overview

Singapore Airlines (SIA) is, arguably, the most successful airline company in the world. This success is reflected in various performance metrics: profitability; customer satisfaction; quality of fleet and airport infrastructure. SIA focuses on the higher-end segment of the passenger market with extensive first class, and business class, capacity. As of March 30, 2011, SIA had a fleet of 108 aircraft with an average age of 6 years, 3 months making SIA “one of the world's youngest and most fuel efficient” airlines in the world (see Fig. 3.B.c). SIA evolved from Malay Airlines, a company founded May 1, 1947. In May 1966, the airline became Malaysia-Singapore Airlines. In 1972, Malaysia-Singapore Airlines divided into two separate companies: Malaysia Airlines and Singapore Airlines. Currently, the biggest shareholder in SIA is the Singapore government which owns 54.95 % of Singapore airlines stock through its investment company Temasek Holdings Ltd (see figure 3.B.a). SIA Group has over 20 different subsidiaries including SIA cargo, SIA engineering company, and Silkair (see figure 3.B.b). The SIA fleet of 108 aircraft is expanded to 137 if SIA

Cargo and Silkair are included. The fleet consists of both Boeing and Airbus aircraft, with 68 owned and 40 on operating lease.

Insert figure 3.B.a List of Major Shareholders in SIA group
 Insert figure 3.B.b SIA Group of companies as of March 31, 2010
 Insert figure 3.B.c Singapore airlines passenger fleet

SIA is a Singapore listed company filing subject to rules in that jurisdiction. As with previous discussion of Australian, US and Canadian firms, difference in filing jurisdiction has some impact of the type and quality of the results presented. Being primarily a long haul carrier, the dramatic importance of jet fuel expense to SIA is captured in Figures 3.B.d and 3.B.e. Over one-third of total expenditures depend on this one item. Yet, in contrast to Canadian reports where risk management activities appear as specific items in the cash flow statement, for SIA it is more difficult to identify information specifically concerned with risk management due to accounting treatment of this item. As indicated in Fig. 3.B.f, no direct information about risk management is provided in the cash flow statement. Rather, relevant information that is available is provided in the 'Financial Instruments' section of the notes to the financial statements. More detail is provided for interest rate and liquidity risk than for jet fuel price risk.

INSERT Fig. 3.B.d SIA SIA Consolidated profit and loss account
 INSERT Figure 3.B.e SIA Group Expenditure Diagram
 INSERT Figure 3.B.f Cash Flow From Operations, SIA 2010

Risk Management Activities

At the beginning of note 38 to the financial statements, "Financial Risk Management Objectives and Policies", SIA states:

"The Group operates globally and generates revenue in various currencies. The Group's airline operations carry certain financial and commodity risks, including the effects of changes in jet fuel prices, foreign currency exchange rates, interest rates and the market value of its investments. The Group's overall risk management approach is to moderate the effects of such volatility on its financial performance. The Group's policy is to use derivatives to hedge specific exposures.

As derivatives are used for the purpose of risk management, they do not expose the Group to market risk because gains and losses on the derivatives offset losses and gains on the matching asset, liability, revenues or costs being hedged. Moreover, counterparty credit risk is generally restricted to any hedging gain from time to time, and not the principal amount hedged. Therefore the possibility of a material loss arising in the event of non-performance by a counterparty is considered to be unlikely.

Financial risk management policies are periodically reviewed and approved by the Board

Executive Committee.”

The first ‘financial’ risk listed is jet fuel prices. This treatment of commodity risk management activities in the notes to the financial statements can be contrasted with the prominent treatment of ‘Risk Management’ in the Annual Report. In the main body of the report, the “Statement on Risk Management” provides the following:

“1. RISK MANAGEMENT EMBEDDED IN ORGANISATIONAL PROCESSES

1.1 Since 2002, a formalised Risk Management Framework has been implemented across SIA Group under which risks are identified, evaluated and controlled on a coordinated and integrated basis. All business units are involved in identifying and evaluating risks from the bottom up, and these risks are then reviewed by Risk Management Committees at Company and Group level to provide a top down perspective as well. Under the Framework, the risks are then prioritised and business units use both preventive and mitigation controls to manage risk exposures within prescribed tolerance limits. These risk management activities are now carried out regularly as embedded organisational processes within the Companies.”

This ‘enterprise risk management’ structured approach to risk reflects the classification of risks in the airline industry given in sec. II.2. More precisely, the “Statement of Risk Management” continues with the types of major event ‘risk’ encountered:

“2 RESPONDING TO MAJOR EVENTS

2.1 Major Events Affecting Airlines and Air Travel

During the 12 months from April 2010 to March 2011, a number of major events affected airlines and air travel generally – from airspace closure over Europe due to volcanic ash clouds, to massive snowstorms in Europe and the USA, to aircraft engine concerns requiring regulatory compliance actions, to massive flooding in Australia and to earthquakes in New Zealand and Japan.

2.2 Risk Responses and Crisis Contingency Plans

“While the specific individual events above were not predictable, the generic nature of the events, such as airspace closure and natural disasters affecting air travel or airline operations, were identified within SIA Group as major risks, and contingency plans were put in place. This permitted the Group to implement coordinated and effective responses in a timely manner. Prior simulation exercises on similar scenarios allowed management to adapt contingency responses to the actual disruption events. Lessons learnt from these events were then incorporated back into the responses.”

The listing of risks continues without mention of jet fuel price risk.

INSERT Figure 3.B.g SIA Company, Financial Expenditure Breakdown

INSERT Figure 3.B.h Sensitivity Analysis for Jet Fuel, SIA

This discussion is not meant to imply that SIA ignores jet fuel price risk. To the contrary, the objective in the discussion is only intended to identify the method of presenting the risk – in the notes to ‘financial instruments’ section of the financial statements – and the commodity risk management methods used to manage the risk. Conventional sensitivity analysis is also provided for interest rates and FX rates. Sensitivity analysis for jet fuel in the main body of the annual report is given as:

“Fuel Productivity and Sensitivity Analysis

Fuel productivity as measured by load tonne-km per barrel (ltk/BBL) decreased 1.5 per cent over the previous year to 425ltk/BBL. This was mainly due to a decline in the overall load factor. A change in fuel productivity (passenger aircraft) of 1.0 per cent would impact the Company’s annual fuel cost by about \$36 million, before accounting for changes in fuel price, USD exchange rate and flying operations. A change in the price of fuel of one USD per barrel affects the Company’s annual fuel cost by about \$36 million, before accounting for USD exchange movements, and changes in volume of fuel consumed.”

Figure 3.B.g is provided in support. Details about the approach to jet fuel hedging does not appear until the notes to the financial statements provide the following:

“The Group’s earnings are affected by changes in the price of jet fuel. The Group’s strategy for managing the risk on fuel price, as defined by Board Executive Committee, aims to provide the Group with protection against sudden and significant increases in jet fuel prices. In meeting these objectives, the fuel risk management programme allows for the judicious use of approved instruments such as swaps and options with approved counterparties and within approved credit limits.”

As illustrated in Figure 3.B.g, the analysis compares jet fuel sensitivity with sensitivities for interest rates and exchange rates. In addition, the notes to the financial statements also provide the sensitivity analysis provided in Fig. 3.B.h.

In contrast to the Canadian oil production companies where detailed information on specific hedges is provided, SIA is less forthcoming:

“The Group manages this fuel price risk by using swap and option contracts and hedging up to 15 months forward using jet fuel swap and option contracts. The Group no longer enters into new gasoil hedges. Existing gasoil swap contracts will be rolled up into jet fuel equivalents by hedging in the gasoil-jet fuel regrade closer to maturity. As at 31 March 2011, all gasoil contracts have matured. The Group has applied cash flow hedge accounting to these derivatives as they are considered to be highly effective hedging instruments. A net fair value loss before tax of \$321.6 million (2010: \$458.9 million), with a related deferred tax credit of \$93.8 million (2010: \$116.9 million), is included in the fair value reserve in respect of these contracts.”

The only further information provided about the jet fuel swap and option contract positions in provided in Note 37 on 'Financial Instruments':

“The fair values of jet fuel swap contracts are the mark-to-market values of these contracts. The fair values of jet fuel option contracts are determined by reference to available market information and the Black-Scholes option valuation model. As the Group hedges its jet fuel requirements in Mean of Platts Singapore Jet Kerosene (“MOPS”) and that the majority of the Group’s fuel uplifts are in MOPS, the MOPS price (2011: USD133.22/BBL, 2010: USD89.59/BBL) is used as the input for market fuel price to the Black-Scholes option valuation model. Consequently, the annualised volatility (2010-11: 26.85%, 2009-10: 23.46%) of the jet fuel swap and option contracts is also estimated with daily MOPS price. The continuously compounded risk-free rate estimated as average of the past 12 months Singapore Government Securities benchmark issues’ one-year yield (2010-11: 0.38%, 2009-10: 0.41%) was also applied to each individual jet fuel option contract to derive their estimated air values as at the end of the reporting period.

The fair values of gasoil and regrade swap contracts are also determined by reference to available market information and are the mark-to-market values of these swap contracts. As the Group hedges in InterContinental Exchange (“ICE”) gasoil and MOPS jet-fuel-ICE gasoil regrade, the ICE gasoil futures contract price and the MOPS price are used as the mark-to-market prices.”

Without more precise information about the structure of the option and swap contracts, the point estimate reporting of sensitivity analysis to assess risk is inadequate due to the lack of information about the convexity associated with option positions.

INSERT Figure 3.B.j Derivatives Financial Instruments, SIA
 INSERT Figure 3.B.k Liquidity Risk 2011

Inspection of Figures 3.B.g and 3.B.j reveals that jet fuel risk is not the only significant risk faced by SIA. Being a Singaporean company reporting in S\$, SIA has significant FX exposure. This exposure is described in note 38 as:

“The Group is exposed to the effects of foreign exchange rate fluctuations because of its foreign currency denominated operating revenues and expenses. For the financial year ended 31 March 2011, these accounted for 63.5% of total revenue (2009-10: 62.4%) and 64.0% of total operating expenses (2009-10: 58.6%). The Group’s largest exposures are from USD, Euro, UK Sterling Pound, Swiss Franc, Australian Dollar, New Zealand Dollar, Japanese Yen, Indian Rupee, Hong Kong Dollar, Chinese Yuan, Korean Won and Malaysian Ringgit. The Group generates a surplus in all of these currencies, with the exception of USD. The deficit in USD is attributable to capital expenditure, fuel costs and aircraft leasing costs – all conventionally denominated and payable in USD. The Group manages its foreign exchange exposure by a policy of matching, as far as possible, receipts and payments in each individual

currency. Surpluses of convertible currencies are sold, as soon as practicable, for USD and SGD .”

The connection between jet fuel prices and the US\$ illustrated Fig. 3.A.e goes unrecognized. The methods employed for handling of FX risk are described as:

“ The Group also uses forward foreign currency contracts and foreign currency option contracts to hedge a portion of its future foreign exchange exposure. Such contracts provide for the Group to sell currencies at predetermined forward rates, buying either USD or SGD depending on forecast requirements, with settlement dates that range from one month up to one year. The Group uses these currency hedging contracts purely as a hedging tool. It does not take positions in currencies with a view to making speculative gains from currency movements.”

The currency risk associated with US\$ exposure associated with future lease payments has been handled separately:

“In addition, the Group has cross currency swap contracts in place with notional amounts ranging from \$30.1 million to \$109.6 million (2010: \$35.9 million to \$128.6 million) where it pays SGD and receives USD at USD/SGD exchange rates ranging from 1.3085 to 1.6990 (2010: 1.3085 to 1.6990). These contracts are used to protect the foreign exchange risk exposure of the Group’s USD-denominated finance lease commitments. The maturity period of these contracts ranges from 21 August 2015 to 14 February 2018.”

SIA reports sensitivity analysis results for both FX and interest rate exposures. In addition to interest rate swaps, the interest rate exposure also involves interest rate caps “maturing in 6 to 7 years, to hedge against risk of increase in aircraft lease rentals”. The payoffs on such instruments are not well captured by the point exposure estimates provided by sensitivity analysis.

The final items in the financial statements relevant to commodity risk management concerns ‘liquidity risk’ and reporting of the fair value of derivative positions (see Figures 3.B.j and 3.B.k). While possible cash requirements for derivative security positions is substantive, these risks are small relative to the overall operations of the company. SIA is more concerned with the liquidity implications of having to meet the cost of firm aircraft deliveries, especially over the next fiscal year. “Due to the necessity to plan aircraft orders well in advance of delivery, it is not economical for the Group to have committed funding in place at present for all outstanding orders, many of which relate to aircraft which will not be delivered for several years.” In conjunction with liquidity risk, SIA also provides a statement about “Derivative financial instruments” in the section on classification of financial instruments (see Fig. 3.B.j).

C. National Airlines: Southwest Airlines Co. (LUV)

“If we don’t do anything, we are speculating. It is our fiduciary duty to hedge fuel price risk.”

Scott Topping, Vice President Treasurer, Southwest Airlines (from Carter et al. 2006b, p.21)

Company overview

Southwest Airlines Co. (LUV) is legendary in the aviation industry as the pioneer of low-cost point-to-point air travel. The LUV website provides the following company description for 2011:

“Southwest was incorporated in Texas and commenced Customer Service on June 18, 1971 with three Boeing 737 aircraft serving three Texas cities - Dallas, Houston, and San Antonio. Today, Southwest is the nation's largest domestic passenger carrier serving 72 cities in 37 states. Southwest flies roughly 3400 flights a day and has roughly 35,000 employees. On May 2, 2011, Southwest completed the acquisition of AirTran Holdings, Inc., and now operates AirTran Airways as a wholly owned subsidiary. Southwest has among the lowest cost structures in the domestic airline industry, consistently offers the lowest and simplest fares, and has one of the best overall Customer Service records”.

LUV ended 2010 with 548 Boeing 737 aircraft serving 69 cities in 35 states throughout the United States and is the largest airline in the US measured using number originating passengers boarded (see Figure 3.C.b). Similarly, the 2010 Annual Report provides the following description of the business model:

“Southwest principally provides point-to-point, rather than hub-and-spoke, service. This allows the Company to maximize the use of key assets, including aircraft, gates, and Employees, and also facilitates the Company’s ability to provide its markets with frequent, conveniently timed flights and low fares. The hub-and-spoke system concentrates most of an airline’s operations at a limited number of central hub cities and serves most other destinations in the system by providing one-stop or connecting service through a hub. Any issue at a hub, such as bad weather or a security problem, can create delays throughout the system. By not concentrating operations through one or more central transfer points, the Company’s point-to-point route structure allows for more direct non-stop routing than hub-and-spoke service and therefore better enables the Company to control delays and total trip time. Approximately 73 percent of the Company’s Customers flew non-stop during 2010, and the Company’s average aircraft trip stage length in 2010 was 648 miles with an average duration of approximately 1.8 hours”.

The use of a single type of aircraft combined with operations out of non-hub airports are central elements in the success of the LUV point-to-point low price business model, e.g., Adler and

Smilowitz (2007).

INSERT Figure 3.C.a Fuel costs for Southwest
 INSERT Figure 3.C.b Southwest Airlines, Aircraft in Fleet and On Order
 INSERT Figure 3.C.c Southwest Airlines Income Statement 2010
 INSERT Figure 3.C.d Southwest Airlines, Cash Flow Statement 2010

The overall scope of LUV operations are captured by the income and cash flow statements (see Figures 3.C.c and 3.C.d). Though the importance of fuel costs in total expenditures will be discussed in more detail below, examination of the income statement permits the level and variation of fuel expense to be compared to other important items such as salaries, wages and benefits or maintenance and repairs over a three year period. Figure 3.C.a details the evolution of fuel expenditures over time. The cash flow statement reveals the dramatic implications that risk management activities can have for commercial operations. The \$2.24 billion cash payment to fuel derivative counterparties could pose significant liquidity problems throughout the firm if such a cash flow drain were not properly anticipated. Fortunately, LUV was able to tap previous cash reserves plus a \$1 billion long term debt issue and a \$400 million revolving credit draw to deal with the liquidity implications. Though LUV has been able to maintain an impressive record of only reporting positive annual earnings results, the cash flow picture is much different. All cash flows associated with purchasing and selling derivatives are classified as operating cash flows in the Consolidated Statement of Cash Flows.

Risk Management Activities

The importance of commodity risk management to LUV corporate strategy is made apparent at numerous points in the 10-K filings. For example, the lead risk identified by LUV in “Item 1A. Risk Factors” of the 10-K filing is the following:

The Company’s business has continued to be significantly impacted by fuel prices, which can be extremely volatile; therefore, the Company’s strategic plans and future profitability are likely to be impacted by the Company’s ability to effectively address fuel prices.

In contrast to SIA, treatment of fuel costs receives considerable and detailed attention in the 2010 10K. Even before recognition under Item 1A, in Item 1 where the business is described, after listing Figure 3.C.a on fuel costs, LUV provides the following significant statement:

The Company has historically entered into fuel derivative contracts to manage rising fuel costs; however, because energy prices can fluctuate significantly in a relatively short amount of time, the Company must also continually monitor and adjust its fuel hedge portfolio and strategies to address fuel price volatility.

The characteristics of the price risk are then described:

For example, during 2008, market “spot” prices for crude oil peaked at a high of over \$147 per barrel and hit a low price of under \$35 per barrel – both within a period of approximately five months. This led to the Company’s decision in late 2008 and early 2009 to significantly reduce its net fuel hedge position in place for 2009 through 2013. As a result of these activities, the Company effectively locked in some hedging-related losses for 2009 through 2013. Since early 2009, the Company has continued to adjust its fuel hedge portfolio in an attempt to economically layer back in some protection in the event of a significant surge in market prices. Fuel costs continued to be volatile during 2010, with market spot prices ranging from a low of \$68 per barrel to a high of \$91 per barrel.

Finally, LUV explicitly acknowledges that a strategy of ‘active hedging’ is being pursued:

Therefore, the Company continues to actively manage its fuel hedge portfolio to address volatile fuel prices and, in particular, to mitigate the impact of significant increases in energy prices, while maintaining an objective to manage derivative premium costs. The Company’s fuel hedging activities are discussed [further in the 10-K] under “Risk Factors,” “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” and Note 10 to the Consolidated Financial Statements.

The amount of information given in the additional items on ‘fuel hedging activities’ is too much to report here. It is more than apparent that management of jet fuel risk is a central component of the lowest-cost-airline business strategy at LUV.

The discussion associated with jet fuel price risk given under Item 1A is revealing about the perception of LUV regarding factors that drive jet fuel pricing:

Fuel price volatility continues to present one of the Company’s most significant challenges, as (i) the cost of fuel, which has been at historically high levels over the last few years, is largely unpredictable; and (ii) airlines are inherently dependent upon energy to operate; therefore, even a small change in market fuel prices can significantly affect profitability. Fuel prices are unpredictable, in part, because of many external factors that are beyond the Company’s control. For example, fuel prices can be impacted by political and economic factors, such as (i) dependency on foreign imports of crude oil and the potential for hostilities or other conflicts in oil producing areas; (ii) limited refining capacity; (iii) changes in governmental policies on fuel production, transportation, and marketing; and (iv) changes in exchange rates.

In addition, strategic implications of jet fuel prices are explicitly recognized:

Likewise, the Company’s ability to react to fuel price volatility can be affected by factors outside of its control. For example, the Company’s profitability is affected in part by its ability to increase fares in reaction to fuel price increases; however, fare increases are difficult to implement in difficult economic environments when low fares are often used to stimulate traffic. The Company’s ability to increase fares can also be limited by factors such

as its low fares reputation, the portion of its Customer base that purchases travel for leisure purposes, the competitive nature of the airline industry generally, and the risk that higher fares will drive a decrease in demand.

This is followed by a statement that characterizes the *ex post* / *ex ante* quandary facing those involved in making commodity risk management decisions:

because energy prices can fluctuate significantly in a relatively short amount of time, the Company must also continually monitor and adjust its fuel hedge portfolio and strategies to address fuel price volatility. These types of adjustments in the Company's overall fuel hedging strategy, as well as the ability of the commodities used in fuel hedging (principally crude oil, heating oil, and unleaded gasoline) to qualify for special hedge accounting, have historically significantly affected, and are likely to continue to affect, the Company's results of operations. There can be no assurance that the Company will be able to continue to cost-effectively hedge against increases in fuel prices.

In other words, there are no guarantees that, *ex post*, the fuel hedging program will be able to achieve the potential benefits that the program was expected to achieve, *ex ante*.

INSERT Figure 3.C.e Fuel Hedges and, Hedge Ratio
INSERT Figure 3.C.f Sensitivity Analysis for Jet Fuel Prices, LUV 2010

In addition to detailed discussion under Items 1 and 1A of the 10-K filing and reporting of specific risk management related amounts in the financial statements, fuel hedging is also examined in considerable detail under: Item 7, Management Discussion and Analysis; Item 7A, Quantitative and Qualitative Disclosures about Market Risk; and, in Note 10 to the Financial Statements. This impressive detail on jet fuel hedging stands in contrast to SIA where the actual hedge ratio was difficult to determine and comparatively more detail was provided on the compensation and stock holdings of board members and senior management. In particular, in Item 7 LUV reports detailed information on the hedge ratio for current and future periods (see Figure 3.C.e) as well as a sensitivity analysis that is reported over a range of jet fuel prices, not the conventional 'if prices change by \$1 then the impact on earnings is \$x". The reported response of LUV hedged fuel costs to changes in the fuel price level reflects the importance of out-of-the-money calls to manage large increases in fuel costs.

The sensitivity analysis is supplemented with information about hedging beyond the next year:

Beyond 2011, the Company has coverage of approximately 60 percent of its estimated fuel consumption in 2012; approximately 50 percent in 2013; and approximately 45 percent in 2014, all at varying price levels.

Further exploration of the discussion in Item 7 reveals:

Fuel and oil expense increased \$576 million, or 18.9 percent, and on a per-ASM basis

increased 18.3 percent versus 2009. Both the dollar and the per-ASM increase were driven primarily by an 18.4 percent increase in the average price per gallon for jet fuel, including the impact of fuel derivatives used in hedging, and including related taxes. As a result of the Company's fuel hedging program and inclusive of the impact of the accounting guidance for derivatives and hedging, the Company recognized net losses totaling \$324 million in 2010 in Fuel and oil expense relating to fuel derivative instruments versus net losses of \$467 million recognized in Fuel and oil expense in 2009. These totals are inclusive of cash settlements realized from the expiration/settlement of fuel derivatives, which were \$153 million paid to counterparties in 2010 versus \$245 million paid to counterparties for 2009. However, these totals exclude gains and/or losses recognized from hedge ineffectiveness, which are recorded as a component of Other (gains) losses, net.

In effect, over the reporting period the jet fuel hedging program lost money. This is followed by the recognition of "frozen" losses from previous periods:

As a result of prior hedging activities, the Company continues to have significant amounts "frozen" in Accumulated other comprehensive income ("AOCI"), and these amounts will be recognized in the Consolidated Statement of Income in future periods when the underlying fuel derivative contracts settle.

LUV goes on to report: "the Company's jet fuel costs per gallon are expected to exceed market (i.e., unhedged) prices during some of these future periods. This is based primarily on expected future cash settlements associated with fuel derivatives, but excludes any impact associated with the ineffectiveness of fuel hedges". These statements regarding losses do not reflect the actual aggregate position of the fuel hedging program given in Item 7A.

Oddly enough, the discussion of fuel hedging in Item 7 is longer and more detailed than the discussion provided in Item 7A where such items typically receive such attention. The Item 7 reporting continues with discussion classified under "Financial derivative instruments". Of interest, LUV reports the scope of the hedging program: "At December 31, 2010, the Company was a party to over 600 financial derivative instruments, related to its fuel hedging program, for the years 2011 through 2014." The aggregate value of the hedging program is then reported:

The fair value of the Company's fuel hedging financial derivative instruments recorded on the Company's Consolidated Balance Sheet as of December 31, 2010, not considering the impact of cash collateral deposits provided to counterparties, was a net asset of \$142 million, compared to a net liability of \$477 million at December 31, 2009. The change in fair value primarily was due to an increase in energy prices throughout most of 2010, the expiration (i.e., settlement in which the Company paid cash to counterparties) of approximately \$153 million in fuel derivative instruments that related to 2010, and the purchase of new derivative positions that will settle in future periods. Although the Company's fuel derivative portfolio was in a net asset position at December 31, 2010, the positions that are expected to settle or expire during 2011 currently consist of a net liability of approximately \$62 million.

Because the mark-to-market value of the hedge portfolio will not necessarily generate corresponding cash flows, LUV observes that: “Changes in the fair values of these instruments can vary dramatically based on changes in the underlying commodity prices, as has been evident in recent years.” Regarding the types of instruments employed, LUV observes: “The financial derivative instruments utilized by the Company primarily are a combination of collars, purchased call options, call spreads, and fixed price swap agreements. The Company does not purchase or hold any derivative instruments for trading purposes.” Significantly, making references to the loss of hedge accounting when gasoline and other non-jet fuel commodities were used to form hedges. The complications associated with cross-hedging leads LUV to report that: “The Company enters into financial derivative instruments with third party institutions in ‘over-the-counter’ markets. Since the majority of the Company’s financial derivative instruments are not traded on a market exchange, the Company estimates their fair values.”

The reporting in Item 7 concludes with the following description of the analytical process involved in determining jet fuel hedges:

The Company continually looks for better and more accurate methodologies in forecasting expected future cash flows relating to its jet fuel hedging program. These estimates are an important component used in the measurement of effectiveness for the Company’s fuel hedges. The current methodology used by the Company in forecasting forward jet fuel prices is primarily based on the idea that different types of commodities are statistically better predictors of forward jet fuel prices, depending on specific geographic locations in which the Company hedges. The Company then adjusts for certain items, such as transportation costs, that are stated in fuel purchasing contracts with its vendors, in order to estimate the actual price paid for jet fuel associated with each hedge. This methodology for estimating expected future cash flows (i.e., jet fuel prices) has been consistently applied during 2010, 2009, and 2008, and has not changed for either assessing or measuring hedge ineffectiveness during these periods.

In this, there are hints that methodologies, such CFaR, that may be “better and more accurate ... in forecasting expected future cash flows” could be explored. There definite hints of a regression based approach using “different types of commodities [that] are statistically better predictors of forward jet fuel prices”.

Given the extent and detail of reporting given in Item 7, information on commodity risk management activities under Item 7A of the 10-K, Quantitative and Qualitative Disclosures About Market Risk, is relatively sparse. Though uncommon, the detailing of risk management items under Item 7, rather than in Item 7A, does happen. For example, investment banks such as Goldman Sachs forgo reporting Item 7A altogether, giving all risk management items in Item 7. This is more than appropriate for financial intermediaries where involvement in risk management is the primary commercial activity of the firm. In turn, treatment of jet fuel hedging is strategically important to the commercial activities of LUV and reporting under Item 7 is, again, appropriate. Given this, the discussion in Item 7A includes a statement of ‘commodity risk hedging philosophy’:

Hedging

The Company utilizes financial derivative instruments, on both a short-term and a long-term basis, as a form of insurance against the potential for significant increases in fuel prices. The Company believes there is significant risk in not hedging against the possibility of such fuel price increases.

This is followed by a precise statement of the risk exposure, indicating the method of measurement, together with a traditional sensitivity analysis:

“the Company expects to consume approximately 1.5 billion gallons of jet fuel in 2011. Based on this usage, a change in jet fuel prices of just one cent per gallon would impact the Company’s Fuel and oil expense by approximately \$15 million per year, excluding any impact of the Company’s derivative instruments.”

The use of active risk management and the current stance on future fuel pricing is then given:

The Company may increase or decrease the size of its fuel hedge based on its expectation of future market prices, as well as its perceived exposure to cash collateral requirements contained in the agreements it has signed with various counterparties. In 2010, the Company added to its fuel hedging position related to expected future fuel purchases.

LUV is engaged in OTC derivative transactions with specific counter-parties that require posting of collateral.

INSERT Figure 3.C.g Collateral and Counterparties, LUV 2010

Considerable attention is dedicated to the cash collateral implications of the OTC jet fuel swaps, an aspect of hedging seldom considered in academic studies. A type of sensitivity analysis is provided for these positions (see Figure 3.C.g). The bulk of OTC is done with five counterparties, with different types of collateral arrangements in place with each counterparty. The following example is provided to describe the cash collateral implications of fuel price changes:

if market prices for the commodities used in the Company’s fuel hedging activities were to decrease by 33 percent from market prices as of December 31, 2010, given the Company’s fuel derivative portfolio, its aircraft collateral facilities, and its investment grade credit rating, it would have to provide an additional \$497 million in cash collateral to its current counterparties.

While LUV does have sufficient cash on hand to meet such as demand, at some point cash draws would impinge on other demands for cash, e.g., to make payments on plane deliveries. The final substantive information in Item 7A concerns the approach to operational risk:

Due to the significance of the Company's fuel hedging program and the emphasis that it places on utilizing fuel derivatives to reduce its fuel price risk, the Company has created a system of governance and management oversight and has put in place a number of internal controls designed so that procedures are properly followed and accountability is present at the appropriate levels. For example, the Company has put in place controls designed to: (i) create and maintain a comprehensive risk management policy; (ii) provide for proper authorization by the appropriate levels of management; (iii) provide for proper segregation of duties; (iv) maintain an appropriate level of knowledge regarding the execution of and the accounting for derivative instruments; and (v) have key performance indicators in place in order to adequately measure the performance of its hedging activities. The Company believes the governance structure that it has in place is adequate given the size and sophistication of its hedging program.

While this does reflect a concern with operational risk, information provided by other companies on the corporate governance structure for risk management, in general, and commodity risk management, in particular, e.g., Fig. 1.A.d for BHP, is not given.

Note 10. Derivative and Financial Instruments

As is common with US 10-K filings, detailed examination of risk management activities, such as the specific use of derivative securities, is provided in a specific note to the financial statements. For the LUV 2010 10-K, the relevant note is 10, though the particular note number will vary from 10-K to 10-K and from firm to firm as there is not a rigid format associated with the numbering of notes similar to the 'Item' format for the body of the 10-K. In Note 10, a description of the hedging program is provided:

Fuel contracts

Airline operators are inherently dependent upon energy to operate and, therefore, are impacted by changes in jet fuel prices. Furthermore, jet fuel and oil typically represents one of the largest operating expenses for airlines. The Company endeavors to acquire jet fuel at the lowest possible cost and to reduce volatility in operating expenses through its fuel hedging program. Because jet fuel is not widely traded on an organized futures exchange, there are limited opportunities to hedge directly in jet fuel. However, the Company has found that financial derivative instruments in other commodities, such as crude oil, and refined products such as heating oil and unleaded gasoline, can be useful in decreasing its exposure to jet fuel price volatility. The Company does not purchase or hold any financial derivative instruments for trading purposes.

This statement seems incongruent with the discussion of counterparty collateral provided in Item 7A. A further description of the selection of derivative securities for use in the hedging program is given as:

The Company has used financial derivative instruments for both short-term and long-term

time frames, and typically uses a mixture of purchased call options, collar structures (which include both a purchased call option and a sold put option), call spreads (which include a purchased call option and a sold call option), and fixed price swap agreements in its portfolio. Generally, when the Company perceives that prices are lower than historical or expected future levels, the Company prefers to use fixed price swap agreements and purchased call options.

However, at times when the Company perceives that purchased call options have become too expensive, it may use more collar structures and call spreads. Although the use of collar structures and swap agreements can reduce the overall cost of hedging, these instruments carry more risk than purchased call options in that the Company could end up in a liability position when the collar structure or swap agreement settles. With the use of purchased call options and call spreads, the Company cannot be in a liability position at settlement.

This discussion hints at a constant question in the structure of commodity risk hedges: whether to use an insurance approach, where premium costs are locked in upfront, or to use hedges with little or no up front costs but that may require cash flow contributions in the future. LUV seeks to answer such questions by using an active hedging strategy that switches between derivative instruments based on the perceived costs, as determined by a ‘view’ on future jet fuel prices.

INSERT Figure 3.C.h Derivative Contracts and Accounting Location, LUV 2010

A fundamental question in commodity risk management that was skirted in the discussion of ‘risk management philosophy’ in Part II concerns the impact of derivative accounting on the incentive to hedge. At numerous point in the 10-K, LUV given copious detail on the accounting methods used and the implications of accounting rules on the selection of particular derivative securities to use in the jet fuel hedging program.

The Company evaluates its hedge volumes strictly from an “economic” standpoint and does not consider whether the hedges qualified or will qualify for hedge accounting. The Company defines its “economic” hedge as the net volume of fuel derivative contracts held, including the impact of positions that have been offset through sold positions, regardless of whether those contracts qualify for hedge accounting. For 2010, the Company had fuel derivatives in place related to approximately 40 percent of its fuel consumption. As of December 31, 2010, the Company had fuel derivative instruments in place to provide coverage on a large portion of its 2011 estimated fuel consumption

Figure 3.C.h provides information about the accounting treatment of various derivative security positions. The desired accounting treatment for LUV is described as:

Upon proper qualification, the Company accounts for its fuel derivative instruments as cash flow hedges. All derivatives designated as hedges that meet certain requirements are granted hedge accounting treatment. Generally, utilizing the hedge accounting, all periodic changes

in fair value of the derivatives designated as hedges that are considered to be effective, are recorded in AOCI until the underlying jet fuel is consumed ...

Unfortunately, not all derivative security hedges are ensured to qualify as cash flow hedges. The following discussion associated with the requisite accounting treatment is a classic illustration of the deterring affect that complicated accounting rules can have on legitimate commercial risk management activities:

The Company is exposed to the risk that periodic changes will not be effective, as defined, or that the derivatives will no longer qualify for hedge accounting. Ineffectiveness results when the change in the fair value of the derivative instrument exceeds the change in the value of the Company's expected future cash outlay to purchase and consume jet fuel. To the extent that the periodic changes in the fair value of the derivatives are ineffective, the ineffective portion is recorded to Other (gains) losses, net in the Consolidated Statement of Income. Likewise, if a hedge ceases to qualify for hedge accounting, any change in the fair value of derivative instruments since the last period is recorded to Other (gains) losses, net in the Consolidated Statement of Income in the period of the change; however, any amounts previously recorded to AOCI would remain there until such time as the original forecasted transaction occurs, at which time these amounts would be reclassified to Fuel and oil expense. When the Company has sold derivative positions in order to effectively "close" or offset a derivative already held as part of its fuel derivative instrument portfolio, any subsequent changes in fair value of those positions are marked to market through earnings. Likewise, any changes in fair value of those positions that were offset by entering into the sold positions are concurrently marked to market through earnings. However, any changes in value related to hedges that were deferred as part of AOCI while designated as a hedge, would remain until the originally forecasted transaction occurs. In a situation where it becomes probable that a hedged forecasted transaction will not occur, any gains and/or losses that have been recorded to AOCI would be required to be immediately reclassified into earnings.

This complex accounting discussion is followed with the proviso: "The Company did not have any such situations occur during 2010, 2009, or 2008."

The implications of this dense accounting treatment on actual commodity risk management activities at LUV is apparent in the following:

Ineffectiveness is inherent in hedging jet fuel with derivative positions based in other crude oil related commodities. Due to the volatility in markets for crude oil and related products, the Company is unable to predict the amount of ineffectiveness each period, including the loss of hedge accounting, which could be determined on a derivative by derivative basis or in the aggregate for a specific commodity. This may result, and has resulted, in increased volatility in the Company's financial results. Factors that have and may continue to lead to ineffectiveness and unrealized gains and losses on derivative contracts include: significant fluctuation in energy prices, the number of derivative positions the Company holds,

significant weather events affecting refinery capacity and the production of refined products, and the volatility of the different types of products the Company uses in hedging.

These qualifications are followed by the assuring statement: “even though derivatives may not qualify for hedge accounting, the Company continues to hold the instruments as management believes derivative instruments continue to afford the Company the opportunity to stabilize jet fuel costs.” However, even in a firm the size of LUV, the complications associated with current ‘hedge accounting’ rules involve considerable effort to satisfy:

Accounting pronouncements pertaining to derivative instruments and hedging are complex with stringent requirements, including the documentation of a Company hedging strategy, statistical analysis to qualify a commodity for hedge accounting both on a historical and a prospective basis, and strict contemporaneous documentation that is required at the time each hedge is designated by the Company. As required, the Company assesses the effectiveness of each of its individual hedges on a quarterly basis. The Company also examines the effectiveness of its entire hedging program on a quarterly basis utilizing statistical analysis. This analysis involves utilizing regression and other statistical analyses that compare changes in the price of jet fuel to changes in the prices of the commodities used for hedging purposes.

In effect, by using “regression and other statistical analyses” LUV appears to engage in a particular type of optimal hedge ratio estimation, albeit for largely accounting purposes.⁷

NOTES

1. Dia and Zeghal (2008) discuss the ‘fuzziness’ of evaluating the risk management profiles contained in annual reports.
2. Barboza (2010) gives some background on this change: “For decades, the benchmark pricing system allowed the steel companies to lock in iron ore prices for a year under annual contracts. Those deals, in turn, allowed mining companies to make long-term investment decisions. But in China, a dual system that had both benchmark prices and spot, or market, prices, led to corruption, with some steel mills agreeing to pay bribes to get cheaper access to iron ore at the lower of the two prices. China’s state-controlled iron and steel association has called the big iron ore producers a cartel and accused them of manipulating prices and negotiating unfairly in closed-door meetings to set the annual price ... Last year, in what some analysts say was a sign of China’s frustration over the negotiations, Chinese authorities arrested four Rio Tinto employees, including an Australian citizen, on suspicions they stole secrets that gave their company an edge in negotiating annual contract prices with Chinese steel mills. Last month, a Chinese court sentenced the four Rio Tinto employees to long prison terms for accepting millions of dollars’ worth of bribes and stealing commercial secrets from Chinese steel executives and passing them on to Rio Tinto.”

3. Though COSL is not directly responsible for the operations of Syncrude, Coutu does serve as Chairman of the Syncrude CEO and Management committees, the key decision making groups within Syncrude. The president and CEO of Syncrude since 2007 is Tom Katinas, previously with Exxon/Mobil the parent of Imperial Oil.
4. SCO has a sulphur content approximately one third of the maximum 0.42% sulphur content for WTI light sweet crude that is deliverable on a NYMEX contract. The API gravity of SCO tests about 32° compared to the minimum 37° to maximum 42° range for NYMEX deliverable WTI.
5. Reference to the use of hedging to provide stability for on-going capital expenditure programs is common in the oil and gas industry. For example, the largest natural gas producer in Canada reports: “EnCana's risk management program continues to supplement revenue and stabilize cash flow. EnCana hedges the price on a portion of its production to provide greater certainty to cash flow generation, which adds stability to the funding of ongoing capital investment” Encana, (Annual Report 2010)
6. Other studies that examine oil price risk management for airlines include Sebehela and Madimabe (2009) and Lu and Chen (2010). Davidson et al. (1987) examine the more general risk management implications of large losses in the airline industry.
7. In addition to jet fuel hedges, LUV also has positions in interest rate derivatives. FX is not an issue with LUV due to its small airport point-to-point strategy which restricts luggage transfer and security clearance activities. As a consequence, LUV is almost exclusively a US domestic carrier and has no direct transactions exposure to other currencies. The limited amount of interest rate swap positions are described in Note 10 as:

The Company has floating-to-fixed interest rate swap agreements associated with its \$600 million floating rate term loan agreement and its \$332 million term loan agreement that are accounted for as cash flow hedges. These interest rate hedges have fixed the interest rate on the \$600 million floating-rate term loan agreement at 5.223 percent until maturity, and for the \$332 million term loan agreement at 6.64 percent until maturity. The ineffectiveness associated with these hedges for 2010 and 2009 was not material.