Fuel Hedging in Asian Airlines

Group Assignment 1

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Abstract

In this report, we choose Cathay Pacific to study fuel hedging practices in the airline industry. We address specific questions asked in assignment 1 in corresponding sections.

For starters, this report analyzes jet fuel hedging as a whole, focusing on the benefits and drawbacks of jet fuel hedging. For one thing, benefits of fuel hedging include reducing profit volatility when oil price change is supply driven, boosting stock prices of airlines and adjusting the timing of profits. For another, fuel hedging prevents airlines from realizing sudden gain from fuel price decline, and increases profit volatility when oil price fluctuation is demand driven.

Then we discuss several determinate factors that major airline companies would consider to decide on their target levels of fuel hedging. We conclude that the main factors are airlines' expectations of future oil price movement and their profit sensitivity to oil price change. Those two major elements are affected by a variety of other factors and are discussed in detail in text. Apart from that, there exist other factors which also have impacts on fuel hedging levels.

A detailed comparison among different hedging instruments is conducted in Chapter 3. After considering pros and cons of futures, options, swaps and collars, especially taking basis risk and into account, we recommend a hedging strategy that utilizing relatively short-term call options on Brent oil as a hedging instruments. This strategy serves as a specific recommendation to Cathay Pacific whose current fuel-hedging method is also examined.

In Chapter 4, Asian airline industry's general fuel hedging strategy is discussed. Asian airlines are characterized by low but heterogeneous level of hedging. Reasons behind this characteristic are provided. Furthermore, other risks needed to be hedged are also pointed out for our company's consideration.

We conclude that oil hedging involves science and art in the practical financial world, and a whole range of factors have to be considered for making strategic decisions.

Contents

I

Jet Fuel hedging as a whole

CHAPTER 1

Jet Fuel hedging

Jet fuel cost amounts to a hefty chunk of total operational expenses of airline companies.Therefore, airlines employ a wide range of financial instruments to hedge against fluctuations in the oil price.
In this section, we discuss the main benefits and drawbacks of jet fuel hedging to understand the rationale behind different hedging strategies employed by airline companies.

1.1 Benefits and drawbacks

Benefits

1. Reduce profit volatility
   The major benefit of fuel hedging is for airline companies to reduce market volatility. Fuel cost accounts for a large percentage of total operating expenses for all airlines. By fuel hedging, airlines are able to stabilize fuel price and the overall expenses, thereby protecting profits against sudden rise in fuel prices.
   When increase in oil price is caused by supply limitations, the decrease in oil supply will usually be accompanied by losses in business and consumer confidence. Reasons for such supply limitations include turmoil in the Middle East, rationing production by OPEC, political sanctions on second suppliers such as Venezuela, and international terrorist attacks. Higher oil price and lower confidence will slow economic activities and lead to lower volume of air travel. Therefore, the profits from locking in lower oil price by fuel hedging can counterbal-

ance lower travel revenues and higher jet fuel costs, thereby reducing profit volatility.

2. Boost stock price
   From the previous point, fuel hedging reduces profit volatility when fuel price is driven by supply limitations. Under these circumstances the stock market will respond to the reduced volatility in profits with higher stock prices. Also, hedging may be a signal to show investors that the airline is well managed and the management is technically alert, thereby investors will value the stock at a higher price. Lastly, airlines who hedge are assumed to have more sufficient free cash flows and healthier balance sheets than those who do not, and will be rewarded by higher stock price. The rationale behind is that fuel hedging requires large margin to back future commitments or pay for the option premium. Therefore airlines near bankruptcy are unable to raise the margin requirements for fuel hedging.

3. Adjust the timing of profit
   Airlines can move profits forward or backward by choosing when to exercise their oil options. In the face of short-term profit downswings, airlines can sell oil futures which are in the money before their closing dates to realize immediate profits. By doing this, airlines are free to adjust cash inflows to an earlier time to show profits or mitigate losses in quarterly reports at the expense of lower profits when hedges are due. Therefore airlines can reduce profit volatility by timing the sale of their oil hedges appropriately.

Drawbacks

1. Prevent sudden gain from decline in fuel price
   The major drawback of oil hedging comes from the very idea of “hedging". According to its definition, a hedge is an investment position intended to offset potential losses by entering into a companion investment. Inevitably, hedging also reduces investors’ potential gains on the other side. Therefore, by its nature, oil hedging prevents sudden gains from decline in fuel prices. When the oil price tanks in a short time, airlines who use zero hedges can immediately benefit from the decline in oil price. However, airlines who enter into oil futures have to pay the exercise price, which is based on the previous market price and will be higher than the spot price. For airlines who enter into oil options, they can reap immediate benefits but their profits will be reduced by the amount of option premium.

2. Increase profit volatility

When oil price moves are demand rather than supply driven, hedging makes profit more volatile (Morrell, Swan, 2006).
When the economy grows fast and the demand for oil surges, the higher demand will make supply tight and drive oil price higher. On the other hand, when demand drops because of economic slowdown, oil price will decline. Air travel also correlates with economic cycles: air travel grows in parallel with economic activity levels and investors' expectation. Therefore, when fast GDP growth drives oil price high, air travel demand will also surge and airlines can realize high revenue and profits from oil hedges at the same time. In contrast, when GDP growth slows down, airlines will suffer from low revenue and losses from oil hedges. In those situations, gains from hedging coincide with high operating profits. On the contrary, hedging adds to airline operating losses when the industry is less profitable. As a result, hedging increases profit volatility when the fuel price change is demand driven.

To further illustrate the relationship between fuel hedging and profit volatility, we should note that whether hedging smooths or exacerbate the profit cycle of airline depends on the underlying factors that drive oil prices change. In periods when oil price is supply driven, hedging makes profit more volatile, whereas in periods when oil price is demand driven, hedging reduces profit volatility.

II

Hedging Strategy

CHAPTER 2

How do companies determine hedge levels?

Generally, airline companies take a whole range of factors into consideration when setting an appropriate hedging strategy to manage the risks and at the same time to keep it consistent with the corporate strategy.

2.1 Main factors affecting hedging levels

Two major inputs to determine optimum hedging levels are **airlines' expectation of future oil price movement** and **firm's profit sensitivity to oil price movement**.

1. Expectation of future oil price movement
   In anticipation of oil price increase, airlines will lift the target level of fuel hedging for the future time period to lock in a lower oil price. In contrast, airlines will decrease the target level of fuel hedging to benefit from future price decrease.

   A variety of factors will influence the expected level of oil supply and demand, thus influencing oil price, the most prominent of which is economic growth. High GDP growth rate boosts oil demand and increases oil price for the future period whereas imminent economic recession indicates weak demand and lower oil price. Besides, political events such as military actions in oil-producing regions and rationing

agreements reached by OPEC countries will limit oil supply and drive oil price high in the future.

2. Profit sensitivity to oil price movement
   Airlines also decide on their hedging level based on their profit sensitivity to oil price movement, i.e. the degree to which their profits are affected by future oil price fluctuation. Keeping other factors constant, airlines whose profits are more sensitive to oil price fluctuation may have higher levels of fuel hedging relative to airlines whose profits are less sensitive to oil price change. In general, airlines are less sensitive to oil price movement when they are more oil efficient, when they have higher bargaining power against oil suppliers, and when they can pass a higher percentage of fuel cost increase to passengers through surcharges. Airlines are more fuel-efficient when they have less oil

   consumption per available seat mile. That can be a result of operating more-fuel-efficient airplanes and have more short-haul air trips than long-haul ones. Further, Airlines with larger scale of economy have higher bargaining power and could negotiate more favorable contracts with oil suppliers and financial intermediaries. Lastly, airlines in Asia and Europe can pass a higher percentage of fuel cost increase to passengers through surcharges on air tickets; whereas American airlines rarely can do that because of more fierce competition in American airline market.

2.2 OTHER FACTORS

Besides the above two main factors. A wide range of other elements also have impact on airlines' fuel hedging levels.

1. Government policy matters. In China, the policies practised by *State-owned Assets Supervision and Administration Commission* (SASAC) of the state council, an institution which polices derivatives trading by state-owned firms, strongly discourage Chinese airlines to enter into jet fuel hedges. Based on the fact that western airlines with high hedging levels suffered big losses in 2008 after the value of their oil futures collapsed alongside the oil price in the global financial crisis, the government encouraged all major Chinese airlines, including China airlines, China Eastern Airlines and China Southern Airlines maintain zero hedging level in the year 2011-2012, the lowest among Asian airlines as shown in Appendix 2-2-1 (Rabinovitch, 2012).
2. The hedge level of airlines also depends on the maturity of the derivative market in different regions. In a region where the derivative market is well-developed and the derivative instruments are highly liquid, airlines have easier access to derivative instruments and more

TABLE 2.1 – Summary of Factors and Their Impacts on Fuel Hedging Levels.

Factors	Impacts
Economic growth Political events OPEC agreement ...	These factors affect future supply and demand of oil, thus airlines' expectation of future price movement
Oil efficiency Bargaining power relative to suppliers Bargaining power relative to passengers ...	These factors affect airlines' profit sensitivity to oil price fluctuation
Government policy	Government in certain regions discourage or ban jet fuel hedging
Management's risk aversion level	Management's attitude towards risk influence corporate hedging strategy
Maturity of derivative market	Airlines in regions with mature derivative market have easier access to fuel hedging
Liquidity of airlines	Lack of liquidity limits airlines' ability to hedge

hedging options. Also, they face lower counter-party default risks when employing hedging strategies. For instance, derivative markets in the US and Europe are relatively mature compared to markets in Asia. Thus US and European airline companies have higher fuel hedging levels than companies in Asia in general as shown in Appendix 2-2-2.

3. Management in different airlines may have different attitudes towards risk aversion and pursue different hedging strategies. Managers who are more risk averse may target a higher level of fuel hedging ratio than those who are more risk tolerant. Likewise, Corporate culture of risk aversion may also influence the current level of fuel hedging.
4. Lastly, airlines near bankruptcy may not be liquid enough to pursue oil hedging strategies as fuel hedging requires large margin to back future commitments or pay for option premium. Thus the liquidity of airlines also limits the level of oil hedging.

In summary, a variety of factors affect the target levels of fuel hedging strategy. We summarized the factors and the impact they have on hedging level in table 2.1 below.

III

Derivative Instruments

CHAPTER 3

AVAILABLE HEDGING TOOLS

Airline companies have many alternatives on oil derivative instruments to fulfill their fuel hedging objectives. Instruments discussed in this chapter include crude oil future and options in the exchange-traded market and swaps, options and collars in over-the-counter market.

3.1 HEDGING INSTRUMENTS FOR AIRLINES

Typically, airline companies have a choice between using exchange-traded including oil futures and options or over-the-counter contracts including swaps, call options and collars.

3.1.1 *Futures*

Although future contracts of jet kerosene are traded in derivative market, the open interest is low. Airline companies, therefore, usually use crude oil futures for jet fuel hedging.

Future contracts of crude oil are standardized instruments stating commitments to buy or sell an asset in the future at a predetermined price, traded in exchanges. Two main exchanges offering these contracts are NYMEX (New York Mercantile Exchange) and ICE (Intercontinental Exchange). Many details are specified in the standardized contract including expiration date and settlement. Both Brent Crude and WTI (West Texas Index) futures are priced in US dollar with contract of 1,000 barrels per contract. Duration of the future contacts varies, for example, monthly WTI future contracts are listed for the current year and next 8 calendar year and 2 additional consecutive contract

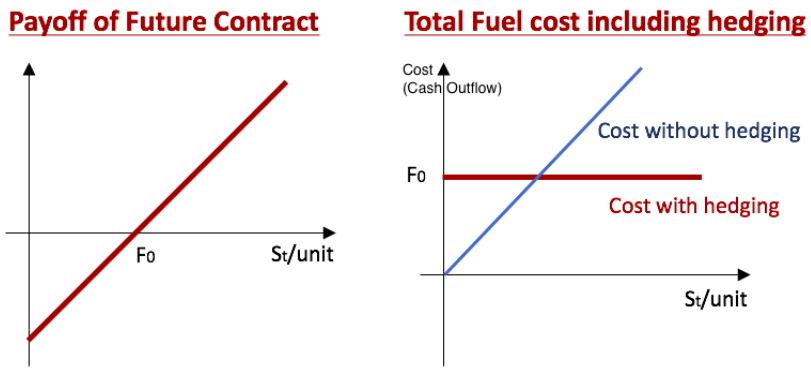
months.Both deliverable or cash settlement contracts can be found in these two markets.

Since future contracts are exchange-traded, counter-party risk is eliminated. There is also a Clearing House using margin requirements to guarantee the financial performance. Another advantage of futures is the high liquidity, according to record from NYMEX, futures of WTI trades nearly 1.2 million contracts a day with over 2 million in open interest. However, the liquidity for contacts beyond one year forward declines significantly.

On the other hand, standardization also brings drawbacks for future contracts. Many contracts set limits on daily movements and one party can only take a limited size of position in a given contract. (Hull, 2009) Underlying assets of future contracts are limited to few types, thus basis risk cannot be ignored as there is a mismatch between the underlying asset of the future (crude oil) and the actual asset.

Airlines take **long position** in futures when hedging. The future contract helps to hedge jet fuel's price risk since the gains in crude oil futures can compensate part of the loss in jet fuel if price increases. Whereas when oil price decreases, benefits from low jet fuel price will also be partially offset by loss in the future markets. This hedging is aimed to lock the price and keep the jet kerosene cost stable. An assumption to be noticed here is that the price

<Figure 3-1> Payoff and fuel cost using future contract



of crude oil is assumed to be highly correlated with the price of jet fuel, which will be further discussed in next section in Basis risk.

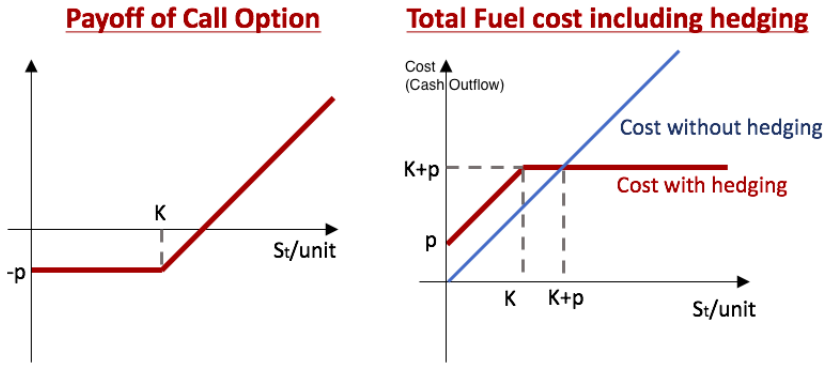
3.1.2 *Swaps*

Swap contracts are **tailor-made** contracts to hedge against price risk. Airlines can hold a swap contract to pay a **fixed price** to jet fuel suppliers. By entering into this contract, companies could enjoy fixed price, helping to eliminate the influence of price fluctuation. **Counter-party risk** cannot be ignored in swap in addition to the difficulty of finding a suitable counter-party.

3.1.3 *Options*

Options are different from instructions discussed above, it gives the holder a **right**, rather than obligation to excise the contract at a predetermined price (strike price K). Airline companies **long call options** to facilitate jet fuel price hedging. By paying a fixed premium, companies could enjoy a more flexible protection of the jet fuel price. When the price drops, they can suffer a limited hedging loss (the paid premium p), while enjoying unlimited profits brought by price increase.

<Figure 3-2> Payoff and fuel cost using call option



Options can be acquired in both exchange-traded market and OTC market. Majority of the options will not go into physical delivery, so the gain or loss are mainly realized through cash settlement. (James 2003, 107.)

Options in exchange-traded market
Similar to futures, the underlying asset of exchange-traded options is crude oil rather than jet fuel. WTI crude oil options of both American and European style are traded in NYMEX, while Brent oil options of American style is mainly traded in ICE. The expiry date of NYMEX ranges from 1 months to 12 months from present (relatively short compared to future contracts). The contract size of all the exchange-traded options are 1,000 barrels per contract. As **standardized contract**, these option contracts also enjoy advantages like **good liquidity** and **no counter party risk**. These contracts will require relatively **less premium** than OTC contracts.

As the graphs (Appendix 3-1, 3-2) display, both trading volume and open interest of crude oil options are much lower than those of oil futures, and the choice of expiry date is limited.

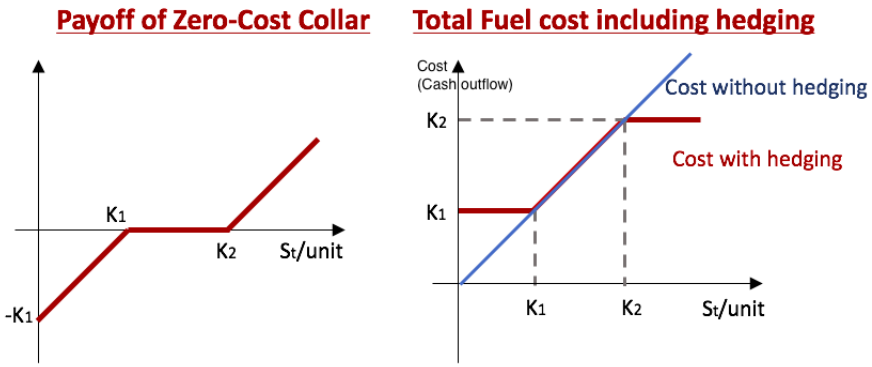
Options in OTC market OTC market provides **tailor-made** derivatives for airlines. It is possible to have options with the underlying asset of jet fuel to eliminate the mismatch; however, these contracts may require a **higher**

premium which increase the cost of hedging, thus, even in OTC market, companies may choose to trade options on crude oil, which has greater trading volume and more transparent price since contracts are also traded in exchange market. However, for OTC options, companies can have contracts cover different time periods, increasing the flexibility of options. Counter-party risk is a concern when options are traded in OTC rather than the exchange market.

3.1.4 *Collars*

Collar strategy is a combination of put and call options. **Zero-cost collar** is a widely-used strategy in the airline industry. To implement the zero-cost collar strategy, an airline sets a price cap for the fuel price (K2) by acquiring a call option for a premium (Hanninen, 2017). In addition, a put option with a lower strike price (K1) will be written to finance the call option. Selling a put option makes airlines forego the ability to benefit from fuel prices below the strike price of the put option (K1), at the same time, the premium of call options will be at least partially **offset** by the premium of the put option and lower the net cost. Ideally, as the name of the strategy implies, the company incurs zero cost for the upside hedging.

<Figure 3-3> Payoff and fuel cost using Collar Strategy



This was a popular strategy in 2008 when oil price hiked to over $140/barrel in mid 2008, as oil price was supposed to keep increasing, the hedging against upside in the future price by longing call option cost a lot. So, companies chose to write put options to fund the call option premium. These strategies, however, made companies exposed to huge hedging loss when oil price dropped to $40 dollars/barrel in 2009. (Thompson, 2011)

The integrated comparison of the instruments mentioned above is shown in the following table 3.1.4.

	Futures	Options	
Market	Exchange-traded market	Options in exchange-traded market	Options in OTC market
Pros	High Liquidity No Counterparty Risk	High Liquidity No Counterparty Risk	Tailor-made Contract More Flexibility
Cons	Basis Risk	Basis Risk	Counterparty Risk Liquidity Risk

3.2 BASIS RISK

In reality, firms that rely on financial derivatives to hedge suffer from basis risk. Due to limited information and limited financial products available in the market, firms rarely could perfectly eliminate the risks involved in their position. It is either hard to find derivatives with the exactly matching underlying, or, firms can not identify the precise date for their future transaction on the contract day. Such mismatches coming in terms of asset and time horizon expose firms to the **basis risk**.

Cathay Pacific, like all other airline companies, are exposed to basis risk.

A special notice about the basis risk that, basis risks apply to almost all the derivatives, including futures and **options**, as options are traded both in Exchange and OTC markets.

3.2.1 *Asset Mismatch*

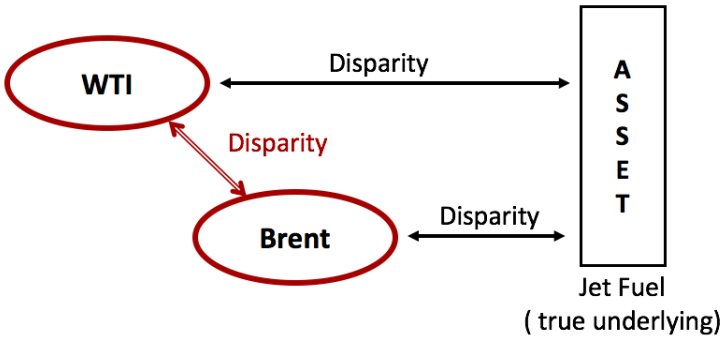
To understand **asset mismatch** in the basis risk in oil hedging industry, we have to first understand the pricing mechanism of crude oil, jet fuel and other related products. Airline firms purchase crude oil for crafts' operation. In other words, airline firms have asset position in jet fuel. Yet jet fuel is refined from crude oil, so there is positive correlation between crude and jet fuel. While there are not many derivatives directly on jet fuel, the crude oil market is the largest commodity market in the world(Valiante and Egenhofer, 2013). In fact, Futures contracts on jet kerosene are only available on the Tokyo Commodities Exchange(TOCOM) and the open interest on these contracts is rather low (Morrel 2007, 191). In addition, these contracts are denominated in Japanese yen, which implies potential exchange rate risk. Therefore, airlines usually employ oil or gasoil futures in hedging the price risk of jet kerosene. (Cobbs & Wolf 2004,3.)

All crude oil varieties are priced against benchmark crude oil for investors to discover any price disparity around the globe. The most important and common ones are the West Texas Intermediate (WTI), ICE Brent, and DME Oman.

Asset basis risk arises when firms use futures with the crude oil as underlying asset to hedge the jet fuel prices. Typically, firms would enter a long position in future contracts to lock the price at certain level. Therefore, the strengthening of the basis implies a loss for airline companies as the effective price they have to pay is higher. These analyses help to explain why many

US airline companies that used WTI-indexed futures contracts in 2011 was affected by the divergence of the WTI from other oil price benchmarks such as the Brent. As one remedy to resolve the asset mismatch is try to find underlying that are highly correlated the true position, the divergence of WTI from Brent signals a lower correlation between the index and the underlying Jet Fuel per sue, given that Brent is a stable correlator across the time. Figure 3-4 visualizes the relationship and helps to understand the mismatch behind the scene.

<Figure 3-4> Illustration of asset mismatch



As for Cathay Pacific, although the underlying of their hedging is Brent, but because of the disparity mentioned above, it is also exposed to the basis risk.

3.2.2 *Time Mismatch*

In addition to asset mismatch, airline firms also suffer from time basis risk, which is the risk arising from hedging with a contract that doesn't expire, settle or mature on the same date as the underlying exposure. This happens as firms are not able to know the exact date of their future transaction.

To be specific, airline companies may not necessarily make jet purchases exactly at the contract expiration date, which is predetermined in the contract. The mechanism of time mismatch roots from the contract itself, which is illustrated in the previous sections.

To deal with such abnormal situations, firms could engage in basis risk hedging by using basis swap or other options.

3.3 CATHAY PACIFIC'S HEDGING POLICY

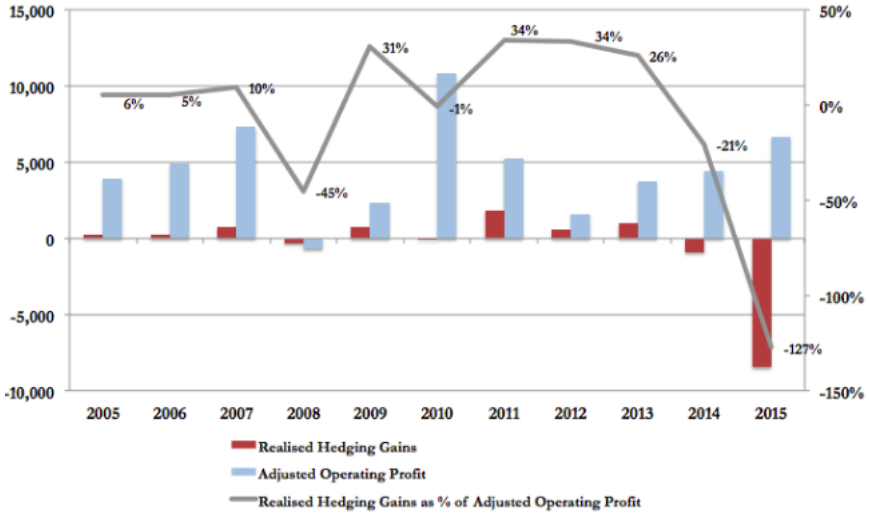
Cathay Pacific implemented a hedging policy by buying call options upon Brent oil with a relatively long duration.

Direct specific information about Cathay Pacific's hedging strategy is not accessible to public as hedging strategy is valuable financial information

which is understandable. However, with option cost in their financial risk management accounting book (Appendix 4-7) and a saying from Cathay Pacific's previous finance director James Hughes-Hallet, the company "is hedging by taking a long position in call options rather than 'using exotic derivatives structures including zero-cost hedges'" (Thompson, 2011). As Appendix 3-3 demonstrated, in 2017, the company is 51% hedged at $89 Brent, 2018 % at $80 Brent.

The duration of Cathay Pacific was rather large in past years. Hedging with four-year duration (Tong,2015) brought great losses since oil market fluctuated a lot and it was very difficult to foresee the fuel price four years later. This is one of the main reasons for the loss the company suffered in recent years (Figure 3-5).

<Figure 3-5> Cathay Pacific's Hedging Loss



Source: CAPA

3.4 RECOMMENDED HEDGING STRATEGY

Call options on Brent oil with duration of one year are suggested to be used to facilitate fuel hedging with following reasons:

3.4.1 *Set the maximum price with a fixed cost*

Call options will help Cathay Pacific set a cap for fuel price, leading to benefits from price increase. At the same time, the loss is limited, with the maximum loss being the total premium. (Figure 3-2)

3.4.2 *One-year duration to increase flexibility*

The main reason for hedging loss suffered by Cathay Pacific is that they were using long-term hedging contract. However, since the crude oil fluctuates dramatically in recent year, a wiser strategy is to use options with shorter duration. Airline companies need six to nine months to reconfigure its schedule for substantial rising fuel price, and a efficient hedging period should cover this. If fuel price keeps being high for over one year, first, the industry will adjust to situation by solutions like using more fuel-efficient aircraft; second, the high fuel price might lead to recession and a drop in oil price later correspondingly, and if the fuel price collapse, hedging duration below one year will enable airlines to fully benefit from future low price.(Thompson, 2011) In a word, derivatives with shorter tenor will be a good choice as it add more flexibility to airlines, taking airlines' reaction time (six to nine month) into account, one-year duration will be a wise hedging choice. Actually, this is also a trend in current market, many US companies with high hedging level are trying to use short-term contract to increase flexibility. According to the chief operating officer Rupert Hogg, Cathay Pacific "won't hedge as far forward as we have in the past".(Skipt, 2017), and the Finance director Martin Murray also said that "We've shortened the period of fuel hedging to two years"(Chen, 2017), which are good signs showing Cathay Pacific have realized the problem of its previous hedging strategy.

3.4.3 *Underlying asset: Brent Oil*

Although companies can use direct hedges in jet fuel itself, the relatively low liquidity on longer-dated contract makes it an uncommon choice. Meanwhile, lower bid-spread makes crude oil contracts a cheaper way to enter hedging, thus a wild-used instruments (Thompson, 2011).

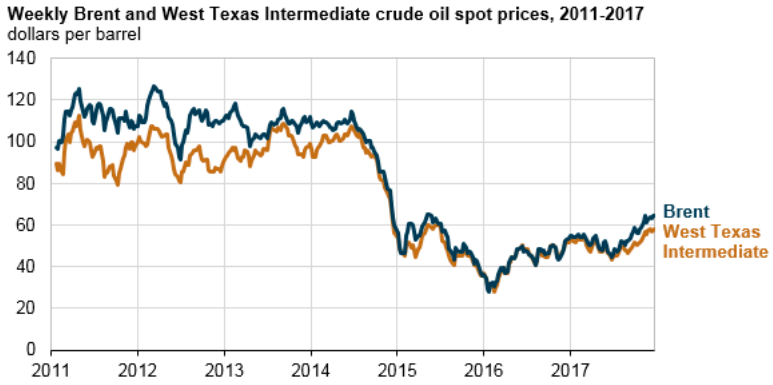
As discussed above, the underlying assets of oil derivatives mainly include Brent and WTI. There appears no reasonable arguments for Cathay Pacific to switch the underlying to WTI. Despite high switching costs of an underlying, the spread between Brent and WTI was high from 2011 to 2014, , making WTI a increasingly precarious benchmark. Although the spread became relatively small in 2015 and 2016, it started to increase again from 2017(Figure 3-6).

Therefore, we would take Brent oil as a better benchmark for jet fuel as it is a more stable tracker of jet fuel price (Appendix 3-4).

3.4.4 *Call option v.s. collars*

In collar contracts, a put option is written to offset part of the cost of the call option. Collar strategy will only be better for the company when the price is above $(K1 - p)$, at this situation, airlines can get a lower total fuel cost than just using call options as illustrated in <Figure 3-7>. However, it is risky if the price is below $(K1 - p)$, then the company will be exposed to a position

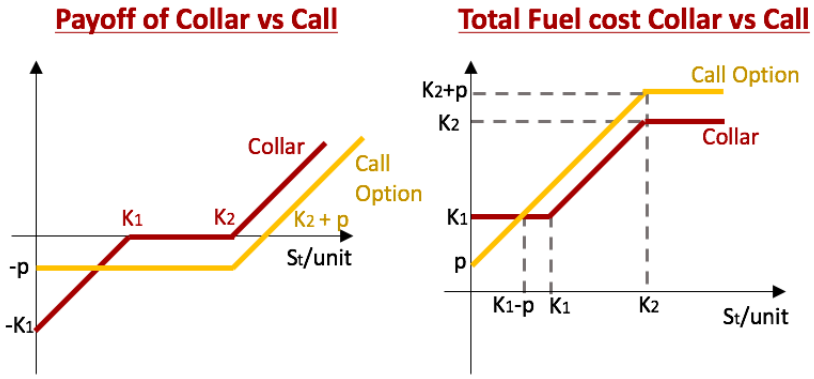
<Figure 3-6> Brent and WTI Spread



Source: U.S. Energy Information Administration

with great hedging loss because of the put option written.

<Figure 3-7> Comparison of call and collar



To use collar, the hedger need to have great confidence about the floor of the price, which is uncertain especially when the oil price is fluctuating as current situation.Just as James said, “There is no such thing as a costless collar", the collar could create significant risks on the downside. Therefore, a simple structured call option is suggested to protect the company from great loss and get benefit from a fixed fuel price when the price of underlying increases.

IV

A closer look at 2011/12

CHAPTER 4

Asian Airlines hedging position in 2011/12

4.1 Low level of hedging in Asian airlines

Asian airline tends to hold low levels of its fuel hedging compared to that of European and American airlines. Two major reasons contribute to Asian airlines' low degree of hedging: lower derivative market exposure and fiercer market competition.

4.1.1 *Low exposure to derivative market.*

Asian market is less exposed to derivative instruments. Appendix 4-1 shows how derivative market size by region in 2007. Asian market is only 13 % of whole world derivatives market size. One possible reason for small volume of derivatives market is government regulation. For example in South Korea, government requires to reveal full details of counter party. (Grant, 2013) Such regulations on derivative instruments make Asian airlines less likely to use derivative instruments to hedge their risk.

4.1.2 *Fierce competition.*

Asian airlines can be better off by not hedging. When there is strong market competition, hedging makes profits more volatile rather than stable. Thus, it is more valid to use low level of hedge when high competition is existed in the industry. Asian airline industry is more competitive compared to European

and American airlines, thus lower level of hedging is desired for more stable profits.

Appendix 4-2 represents market share of airlines by its region. Market share of major five airlines in Asia decreased from 36% in 2000 to 26% in 2015. During the same period, market share of major five airlines in Europe increased their market share from 37% to 50 %. Also, Top four airlines market share in America is over 80%.

Decreases in market share of major players in Asia implies high competition level in Asia. Aggressive competition in Asia mainly came from new launch of Low Cost Carriers(LCC). Appendix 4-3 shows major new launch of LCCs around Asia since 2006: 9 LCCs have launched and brought challenges to major players.

4.2 HETEROGENEOUS HEDGING LEVELS AMONG ASIAN AIRLINES

Although Asian airlines in general maintain lower hedging levels compared to European and American airlines, Asian airlines show different levels of hedging ratio among themselves. Fierce competition and government regulation cannot explain this heterogeneity of hedging levels among Asian airlines. Rather, we suggest that the diverse hedging ratios are resulted by the diverse financial risks faced by different airlines.

Appendix 4-4 demonstrates a clear relationship between firm's hedging ratio and its ranking of financial risks. When an airline is exposed to higher financial risk, it is more likely to have higher level of hedging: this is understandable as when an airline has higher level of financial risk, it has higher incentives to reduce other risks which comes from fuel price fluctuation to stabilize its cash flows and operations.

4.3 JUSTIFICATION OF LEVEL OF HEDGING

Cathay Pacific chose a 27 % of hedging ratio, which was relatively higher compared to other Asian airlines. However, based on the reasons stated above, this level of hedging ratio was fully justified by its higher financial risk: based on the regression model in (Appendix 4-4), Cathay Pacific's hedging ratio of 27% was reasonable for a 5-level(highest) financial risks.

4.4 OTHER RISKS TO BE HEDGED

Other than fuel price, which are the major risk to be hedged against, there are other factors that airlines should not ignore. Two major components include interests risk and currency risk.

4.4.1 *Interests Risk*

Airline industry is usually highly debt financed and Cathay Pacific paid an amount of HK$1,629 million interests expense in 2012 specifically. Airlines generally choose to lease their aircrafts rather than direct purchase them which incurred high lease obligation. Cathay pacific also showed adequate debt level. Appendix 4-5 shows Cathay Pacific's capital structure. Its debt to equity ratio in 2012 was 0.63.

Cathay Pacific can hedge risks from interests by utilizing interest rate swap(IRS). By using IRS, it can lower its interest rate and chose preferred format of interest rate payment: fixed or float. Appendix 4-6 illustrates Cathay Pacific's IRS engagements in 2012: Cathay Pacific does not reduce its financial costs significantly after using derivatives, it gained from EUR and USD outstanding debts, but lose in JPY outstanding debts. Yet, Cathay Pacific had shown clear trends to reduce volatility coming from floating rate interests debt, by transferring it to fixed rate interests of debt. Cathay Pacific's debt was composed of more than 60% of floating rate in 2008, but was able to reduce it to about 30% in 2012.

4.4.2 *Currency Risk*

Airline industry is a multinational business. Thus, revenue is composed of various currencies. Cathay Pacific is no exception and it provides services to diverse countries. Appendix 4-7 demonstrates the diversified business regions involved by Cathay Pacific and its cross-country revenue composition. Around 55% of its revenue came from outside of Hong Kong and Mainland China, where located its headquarter. Thus, Cathay Pacific is exposed to currency risk operationally and financially.

Cathay Pacific can hedge its currency risk by implementing derivative instruments related to currency, such as currency rate forwards and currency rate swaps to hedge its currency risk. Appendix 4-8 shows Cathay Pacific's hedging account and illustrates how it uses currency forwards and swaps to hedge against currency risk.

CHAPTER 5

Conclusion

We conclude in this chapter that oil hedging involves both science and art in the practical financial world. A whole range of factors have to be considered for each airline company to making its strategic hedging decisions.

Despite some drawbacks, oil hedging in general provides a great platform for airline companies to hedge against high levels of operational risks involving jet oil prices. There are many factors to take into consideration in order for each individual firm to set its optimal hedging policy, among which the most important ones are firm's expectation about future oil demands and supplies, and how its profits co-move with oil price. We also address some practical concerns such as basis risks. We then analyze some of the major hedging derivatives available in the market and make our recommendations for Cathay Pacific based on its financial and operational stance. In the last part of our report, we give a closer look at the airline industry in Asia during 2011 and 2012. We compare and contrast its performance with other markets around the world. We give possible explanations of the low and disparate hedging levels among airline companies at that time.

From this report, we have better and deeper understandings of financial derivatives. Not only we apply theoretical knowledge acquired in the class about financial derivatives in practical airline industry context, but we appreciate how financial derivatives enable firms to better manage risks. We understand how those financial contracts work in the real world and also acknowledge their limitations. This project helps us have a better grasp of the related knowledge and further motivates our interests in financial derivatives and risk management.

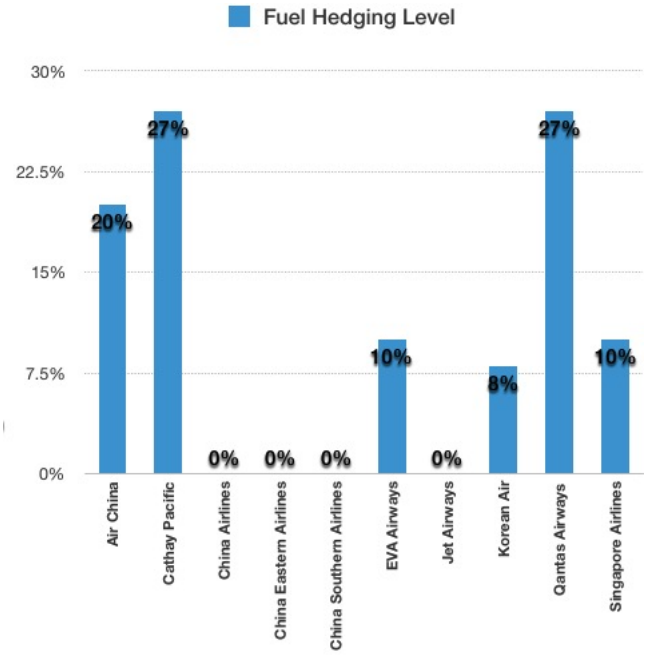
V

Appendices

CHAPTER 6

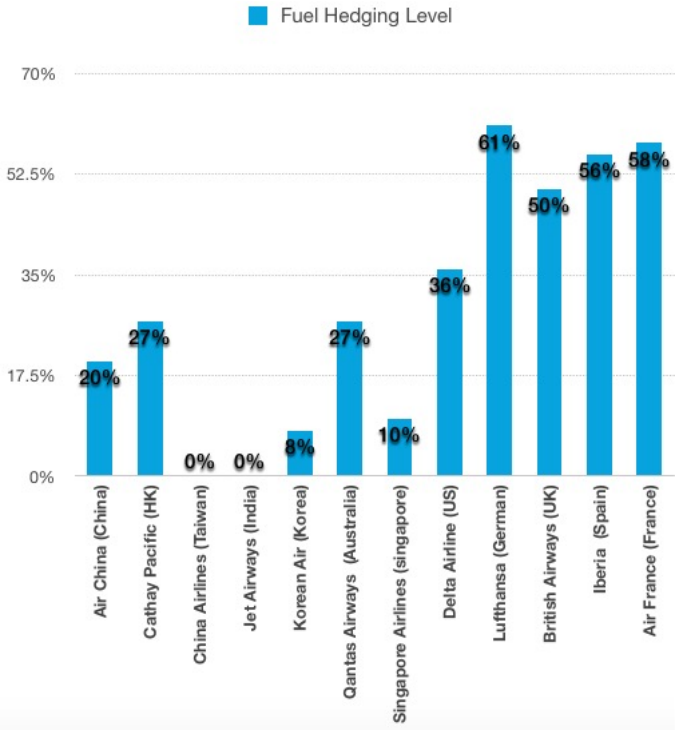
APPENDIX

<Appendix 2-2-1> Fuel Hedging Level of Asian Airlines (yr 2011-2012)



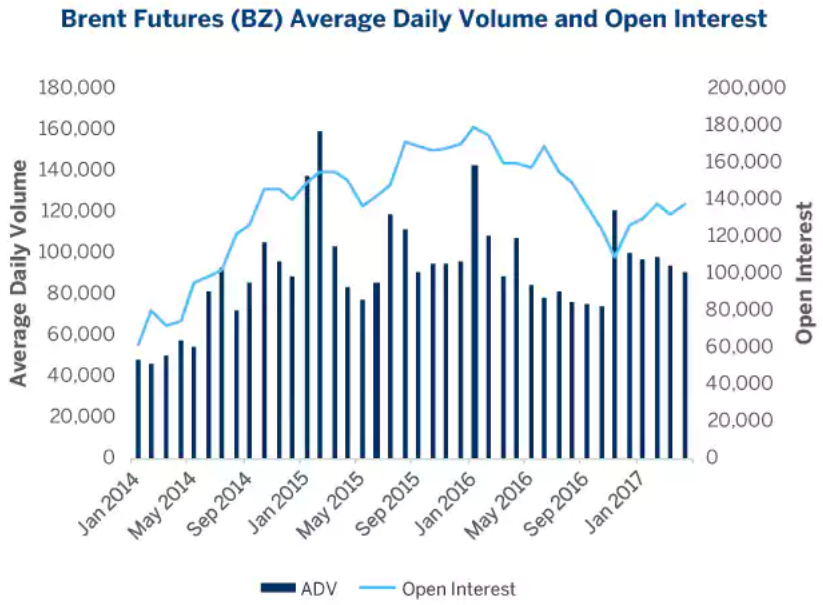
Source: Finance Times

<Appendix 2-2-2> Fuel Hedging Level of Airlines in different regions (yr 2011-2012)



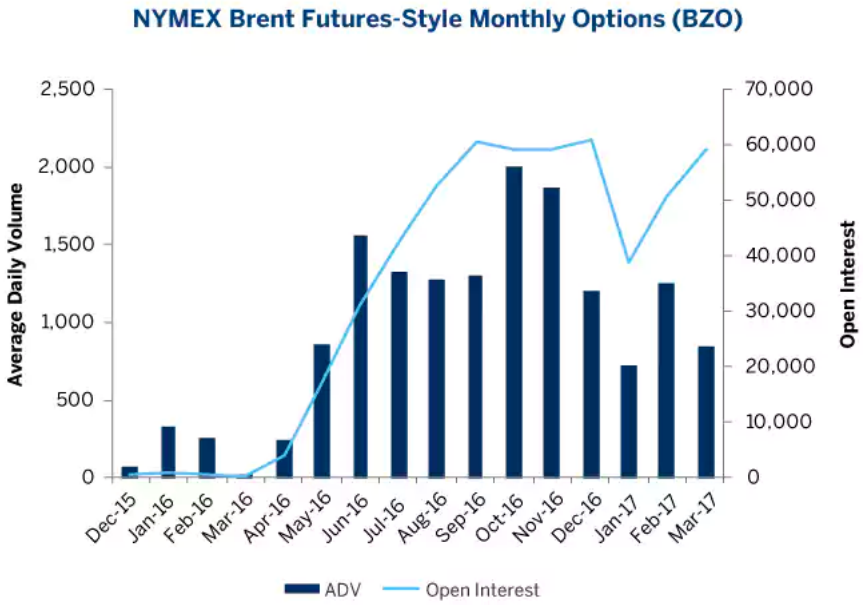
Source: Finance Times

<Appendix 3-1> Brent Future Trading Volume



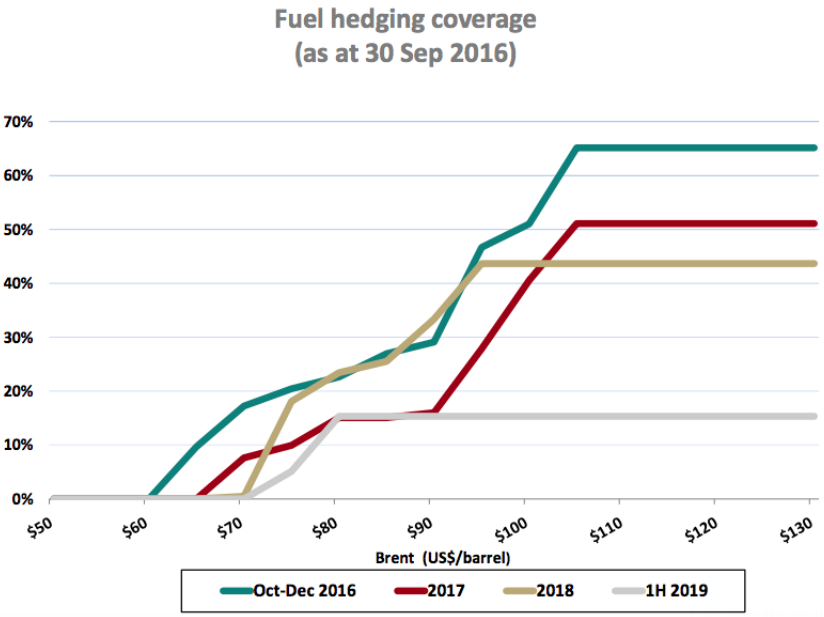
Source: Intercontinental Exchange

<Appendix 3-2> Brent Options Trading Volume



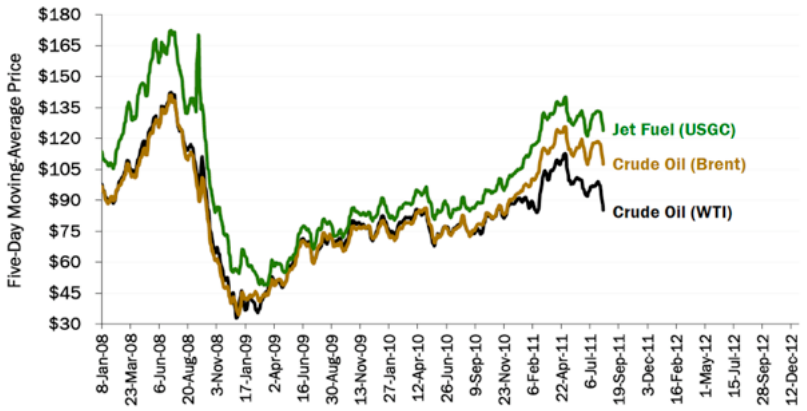
Source: Intercontinental Exchange

<Appendix 3-3> Cathay Pacific Hedging Strategy



Source: Cathay Pacific 2016 Analyst Report

<Appendix 3-4> Brent, WTI vs Jet Fuel

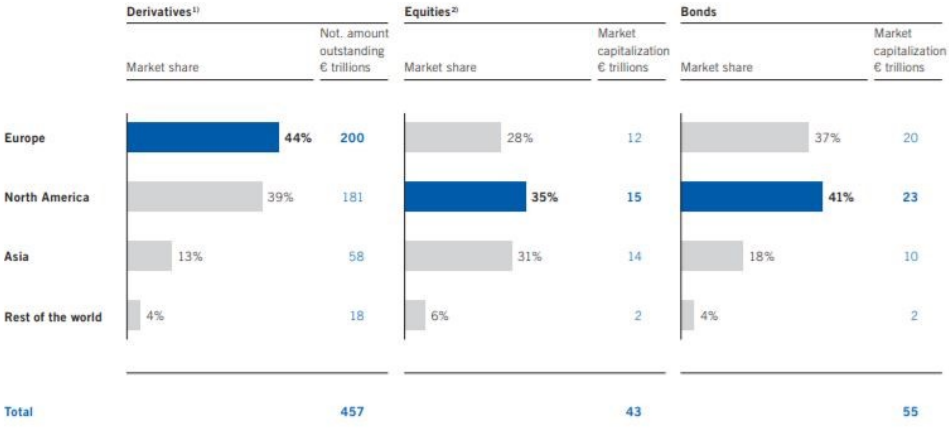


Source: CAPA

<Appendix 4-1> Derivative Market Size by region

Exhibit 5: Regional breakdown of the global derivatives, equity and bond markets

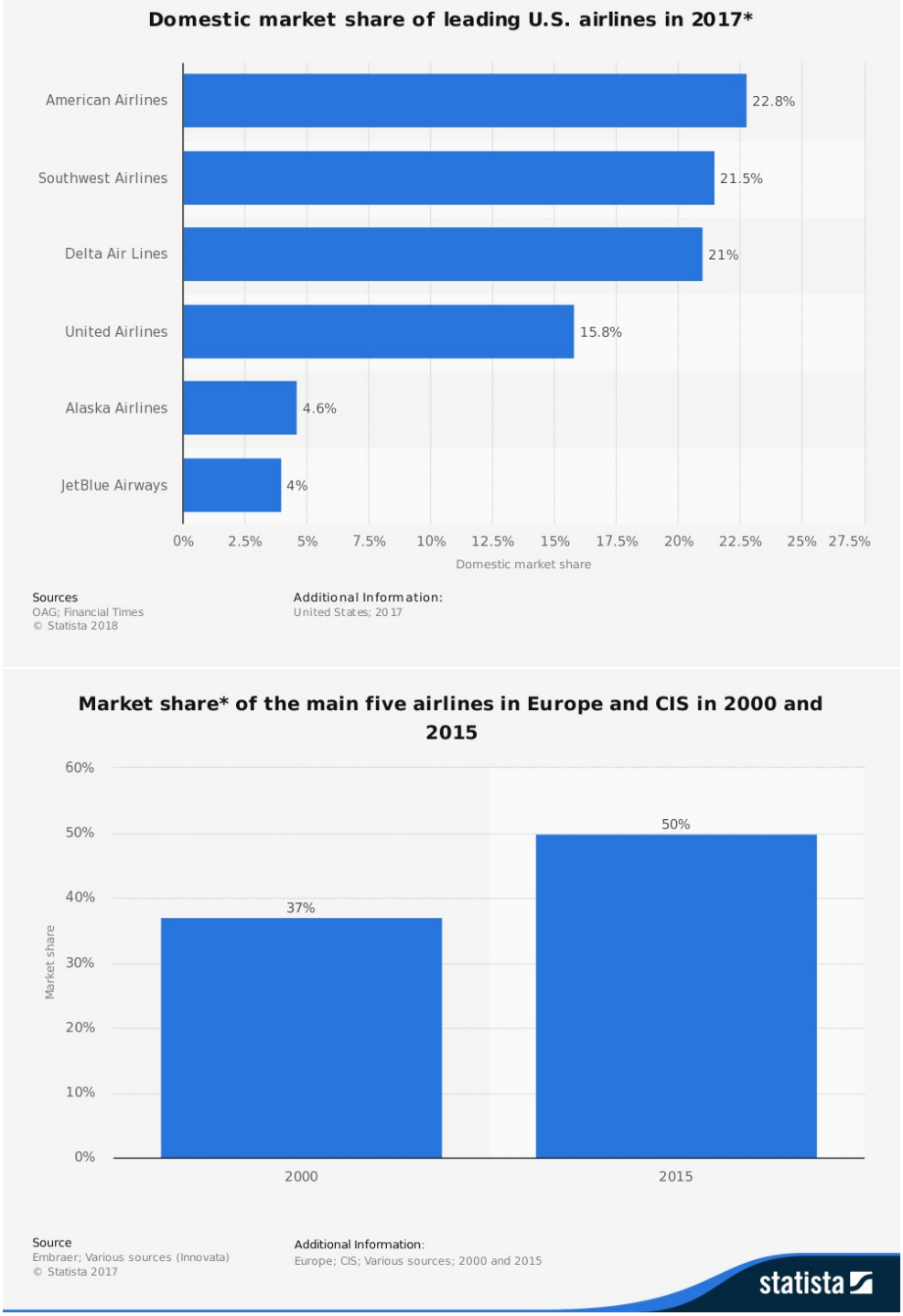
June 2007

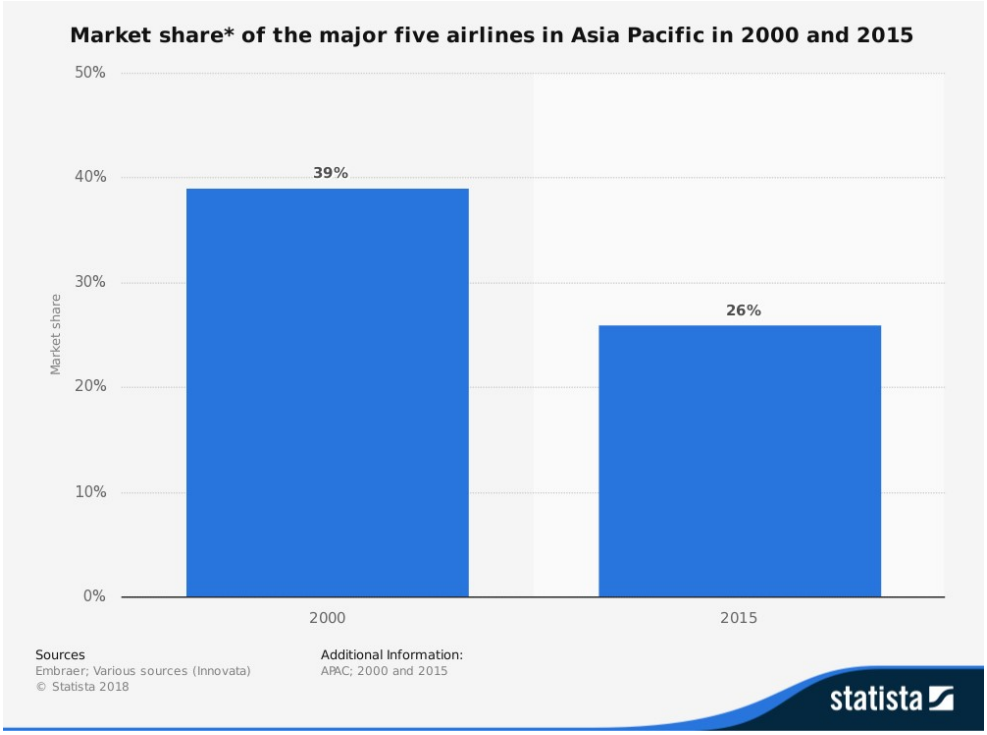


1) Regional split for OTC derivatives according to underlying equity, currency of underlying interest rate, and currency of foreign exchange derivatives
2) As of December 2007
Source: BIS, WFE

Source: Deutche Borse Group

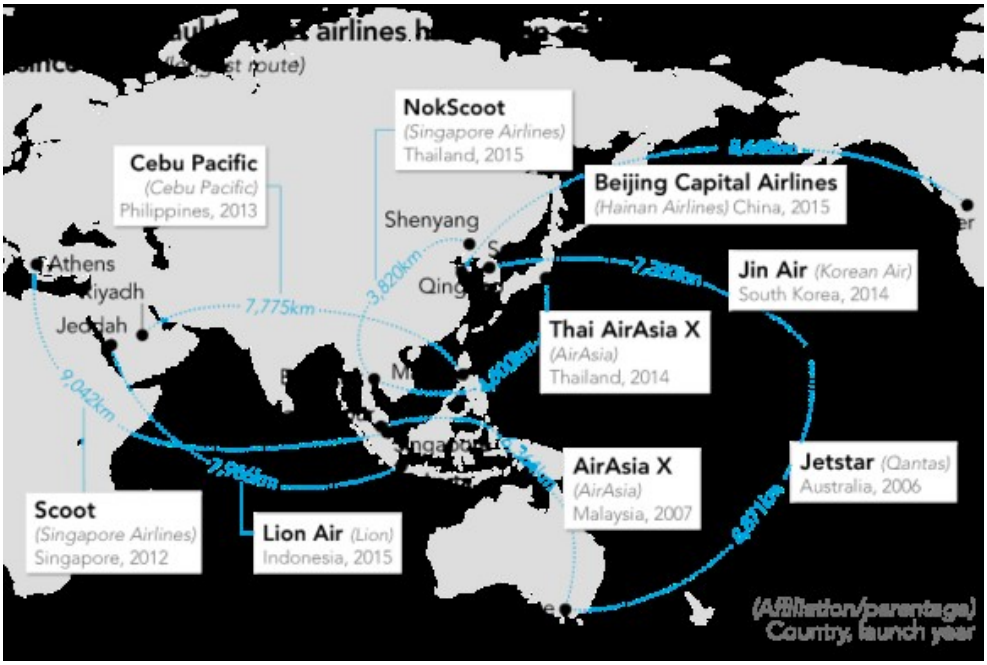
<Appendix 4-2> Airline market share by Region





Source: Statista

<Appendix 4-3> Launch of LCCs in Asia



Source: CAPA

<Appendix 4-4> Relationship between hedging ratio and finance risk of airlines

16. HSBC ranking of airlines in a high fuel cost environment (where 5 is best and 1 worst)

	Fleet	Traffic mix	Routes	Financial risks	Score
Air China	3	3	3	4	✈✈✈✈
Cathay Pacific	2	5	1	5	✈✈✈✈
China Airlines	1	4	2	2	✈
China Eastern	4	2	4	2	✈✈✈
China Southern	5	1	4	2	✈✈✈
EVA Air	2	4	2	3	✈✈
Jet Airways	5	4	3	1	✈✈✈✈
Korean Air	1	4	3	2	✈
Qantas Airways	1	4	3	5	✈✈✈✈
Singapore Airlines	4	5	1	5	✈✈✈✈✈

Source: HSBC

Airline	Fuel hedging level	Net profit impact of 5% fuel price rise
Air China	20%	-4%
Cathay Pacific	27%	-4%
China Airlines	0%	-16%
China Eastern Airlines	0%	-21%
China Southern Airlines	0%	-15%
EVA Airways	10%	-10%
Jet Airways	0%	-31%
Korean Air	8%	-16%
Qantas Airways	27%	-3%
Singapore Airlines	10%	-4%

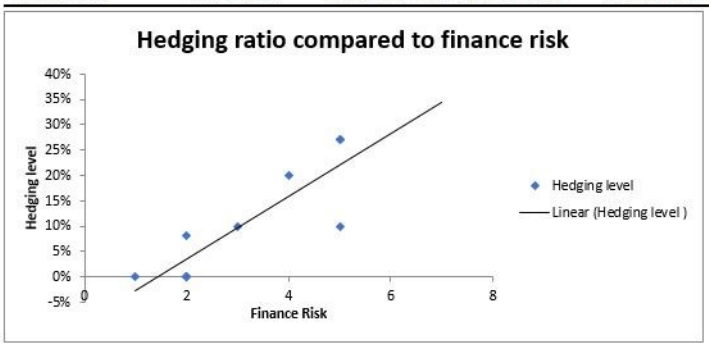
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.86331286
R Square	0.74530909
Adjusted R Square	0.71347273
Standard Error	0.05868067
Observations	10

ANOVA

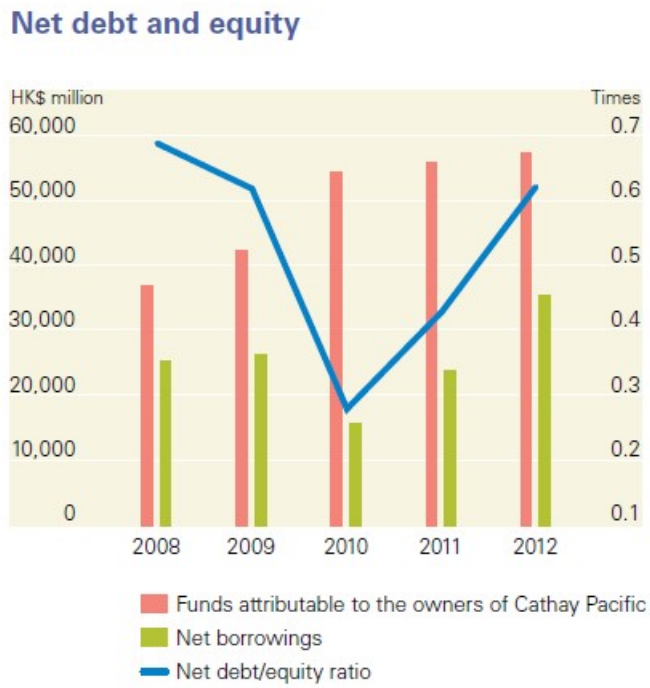
	df	SS	MS	F	Significance F
Regression	1	0.080612632	0.080613	23.41062	0.001290668
Residual	8	0.027547368	0.003443		
Total	9	0.10816			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Jpper 95%
Intercept	-0.09052632	0.043905088	-2.06186	0.073148	-0.191771631	0.010719
Finance Risk	0.06210526	0.01283577	4.838453	0.001291	0.032505925	0.091705



Source: HSBC, FINA4110 group assignment

<Appendix 4-5> Cathay Pacific Debt to Equity Ratio



Source: Cathay Pacific 2012 annual Report

<Appendix 4-6> Cathay Pacific Interests rate swap results

Source: Cathay Pacific 2012 annual Report

<Appendix 4-7> Cathay Pacific's business segmentation by region

2. Segment information *(continued)*

(b) Geographical information

	2012 HK$M	2011 HK$M
Turnover by origin of sale:		
North Asia		
– Hong Kong and Mainland China	**44,970**	42,915
– Japan, Korea and Taiwan	**12,775**	13,598
India, Middle East, Pakistan and Sri Lanka	**4,521**	4,708
Southeast Asia	**7,968**	7,259
Southwest Pacific and South Africa	**6,875**	7,136
Europe	**8,760**	9,518
North America	**13,507**	13,272
	99,376	98,406

Source: Cathay Pacific 2012 annual Report

<Appendix 4-8> Cathay Pacific's Hedging Account

(d) Hedge accounting

The carrying values of financial assets/(liabilities) designated as cash flow hedges as at 31st December 2012 were as follows:

	2012 HK$M	2011 HK$M
Foreign currency risk		
– long-term liabilities (natural hedge)	**(6,170)**	(2,303)
– cross currency swaps	**(2)**	(1,062)
– foreign currency forward contracts	**(92)**	(231)
– foreign exchange swap	**1**	–
Interest rate risk		
– interest rate swaps	**(939)**	(695)
Fuel price risk		
– fuel options	**1,142**	749
Others		
– carbon offsets	**(34)**	(168)

Source: Cathay Pacific 2012 annual Report

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