Price Volatility of Commodities – Impact on Biofuels Production & Supply

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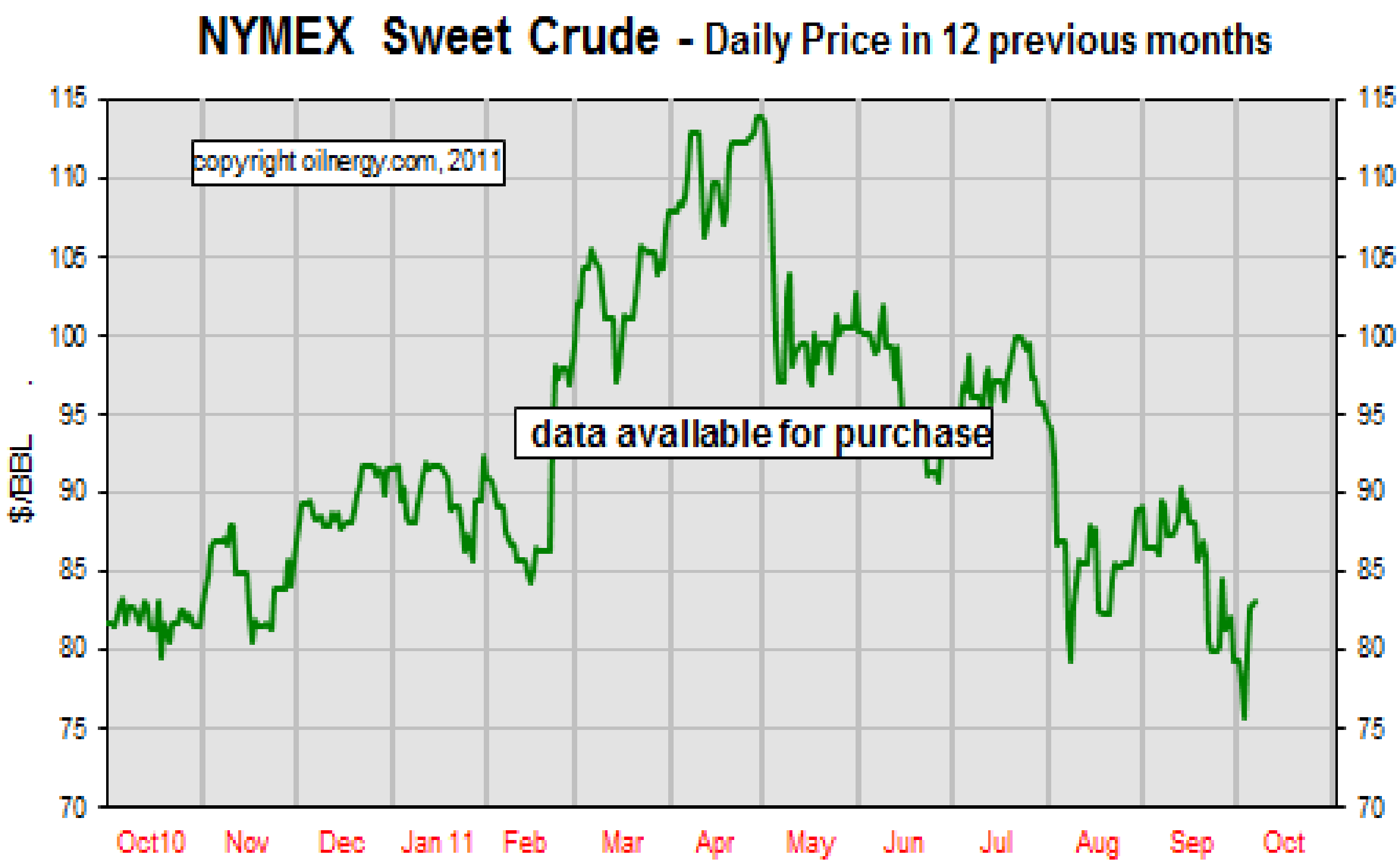
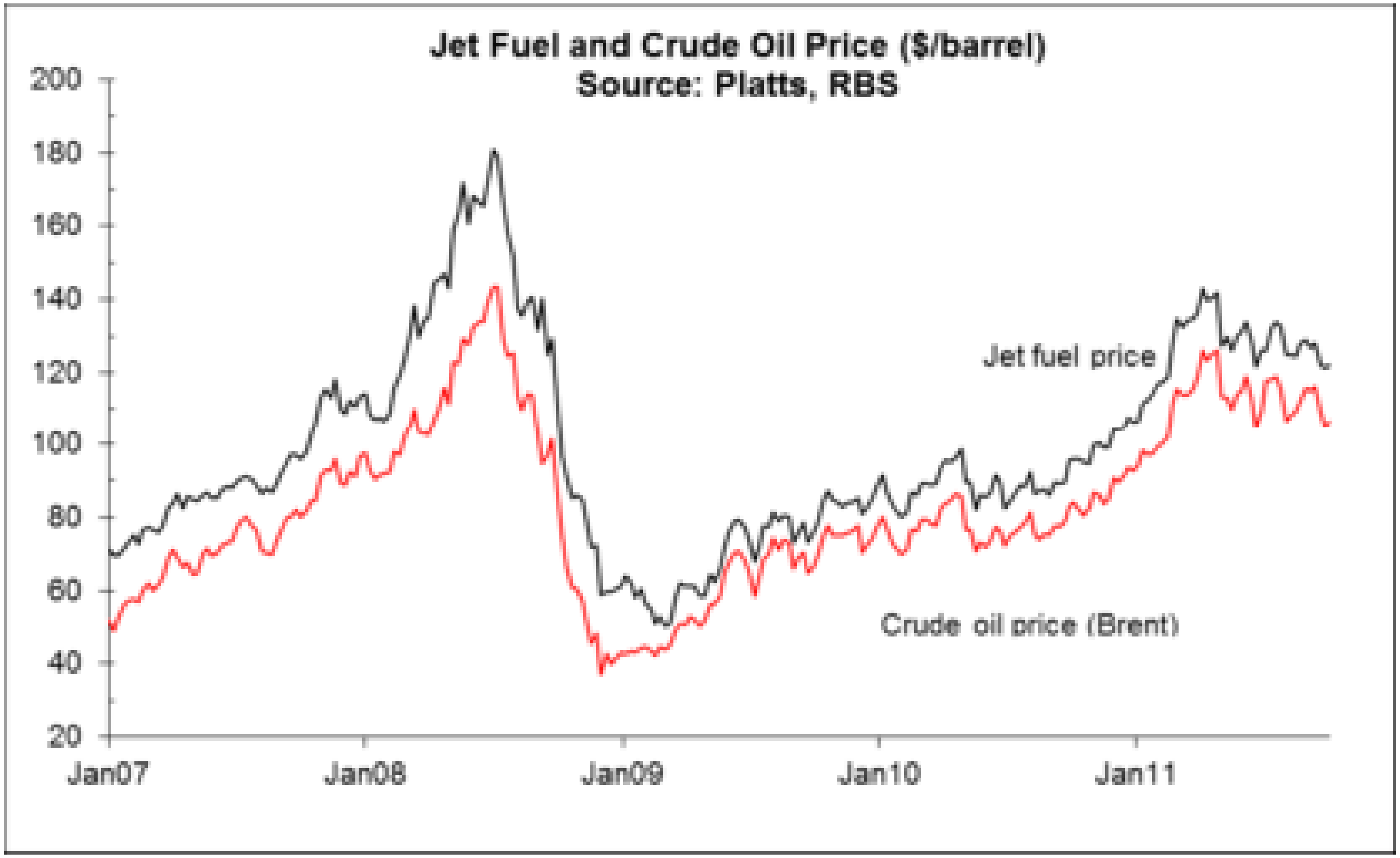
Overview:

- Airline sensitivity to jet fuel price and mitigation strategies
- Volatility in biofuels market
- Categorization of risks
- Market risks
- Mitigation measures

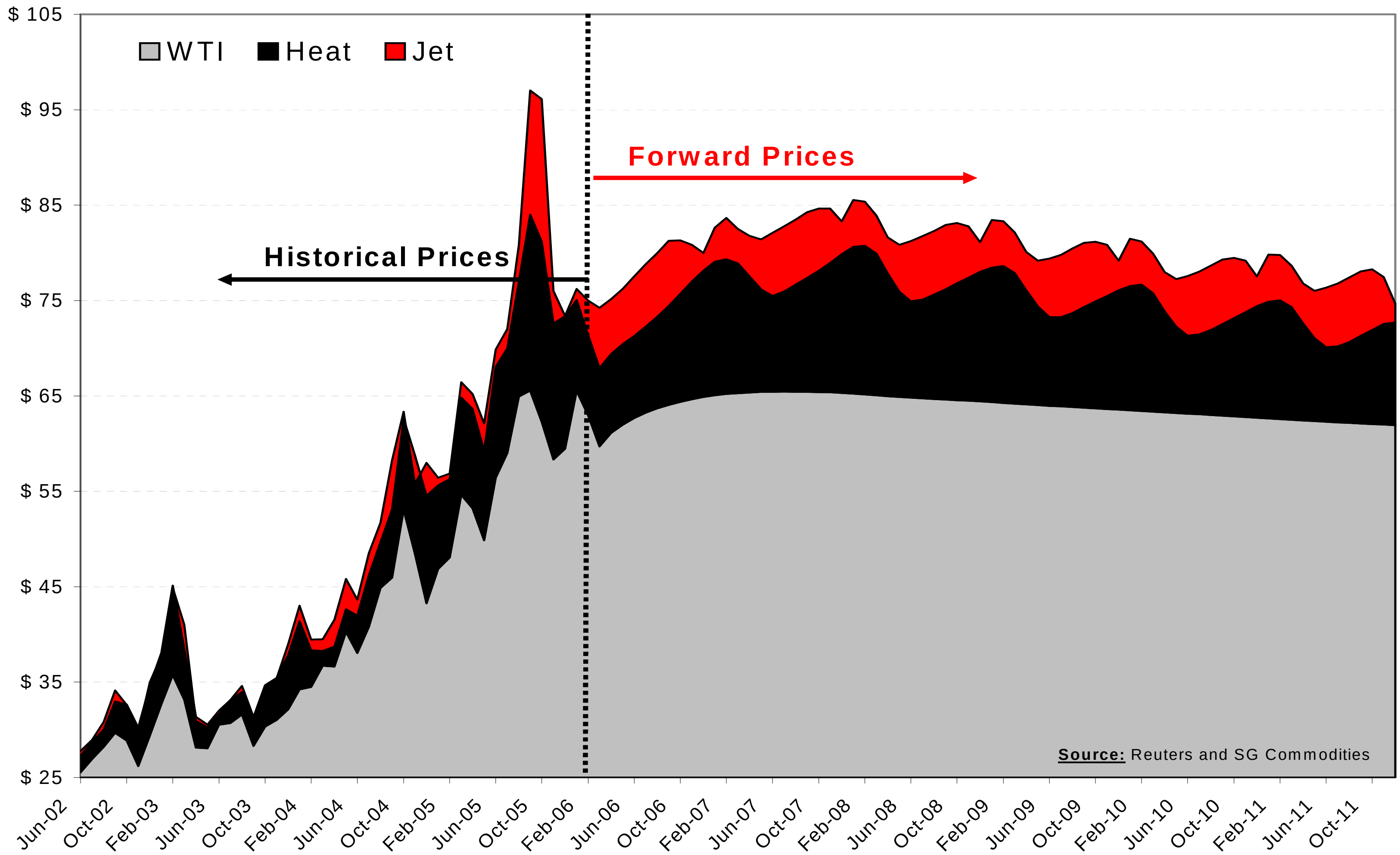
Volatility in Oil market



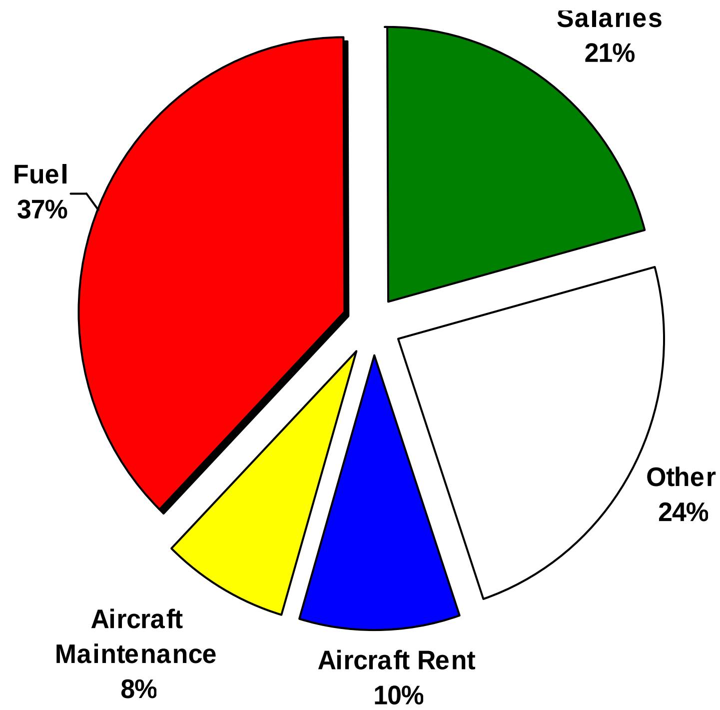
Jet fuel and crude oil prices move in tandem



Volatility in Jet Kero Spread



Jet Fuel as a cost – Now !

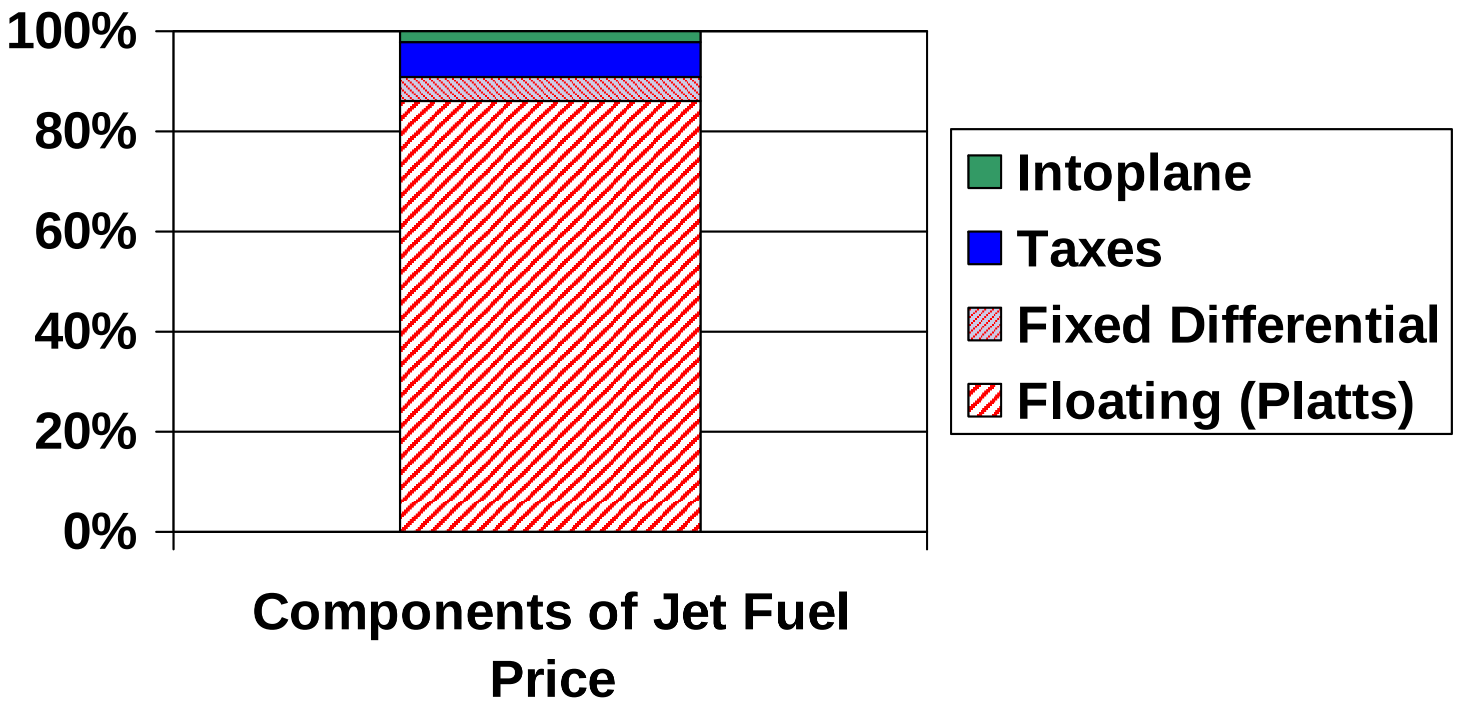


A Sample Airline

Actual Expense Ratios

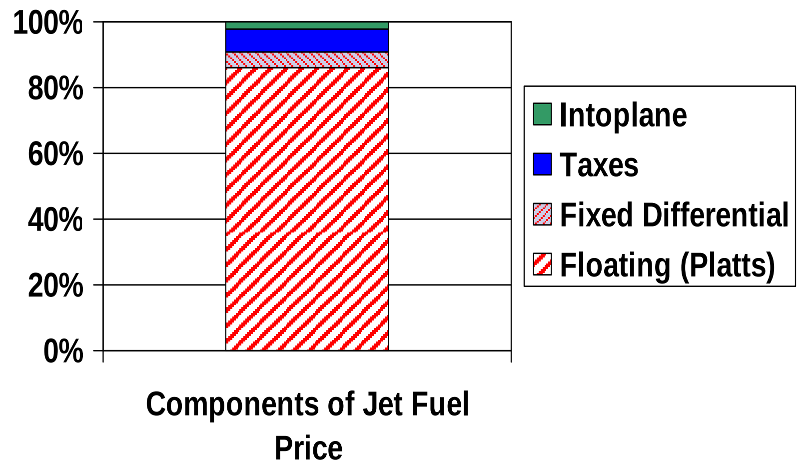
And for some airlines, fuel as % of DOC can go up to 50%!!

The vast majority of an airline's total jet fuel price is "floating".



Fixed differential

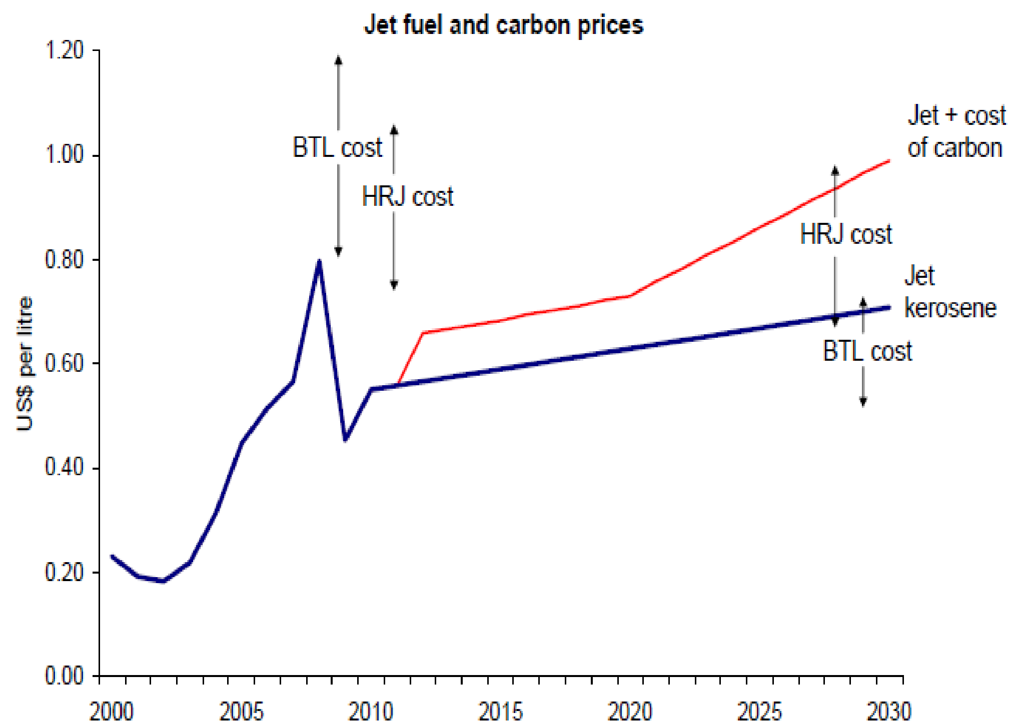
- Also called the oil company/supplier margin
- Negotiated as a fixed fee in the contract
- Cost of logistics to bring products to an airport
- Includes oil company profit
- Cost varies from airport to airport depending how product is transferred from refinery (pipeline, rail, ship, trucks)



Price gap

- Differential can vary from a few cents to above 10 USC/USG especially for landlocked locations
- Biofuel plants/facilities were located in close proximity to those airports
- Price gap would be narrowed significantly
- Regional approach to biofuels supply fast track deployment

Chart 1: Aviation biofuel supply costs and the cost of using jet kerosene



Source: Jet and cost of carbon based on UK DECC central case forecasts for oil prices and traded carbon prices. Biofuel costs various sources described below. All are in constant (inflation adjusted) US dollars.

Volatility in oil prices:

- OPEC production policies
- Geopolitical uncertainties
- Strong demand – especially in Asia
- Economic environment – Sovereign debt in Europe
- Low petroleum inventories
- Refinery bottlenecks and periodic problems
- Dollar strength
- Speculative activity - institutional and fund trading
- Technical Factors

Airline profit falls as fuel costs rise

- “Airlines are anticipated to earn less money this year as compared to year 2010, as higher fuel prices outweigh a forecasted rise in passenger numbers”
- IATA: Fuel average price for 2011: $3/USG
- 27.5% increase from 2010
- Impact on 2011 fuel bill in excess of $60 billion
- IATA has forecasted earnings of $9.1bn in 2011, down from $15.1bn in 2010”.

Mitigate price risks through Hedging

HEDGE OBJECTIVES

"Disaster Insurance"

"Budget Protection"

Risk Mitigation

- Volatility can be extreme in the oil market (ex. in 2008 price plummeted from $140 to 40/bbl)
- Hedging using financial derivatives like swaps, collars, call and put options – well established practice in aviation industry
- Mitigation through:
  - Fuel surcharges - transferring the risks to consumers
  - Fuel conservation measures – save every drop of fuel

Industry has learnt how to deal with oil price volatility

ICAO AVIATION AND SUSTAINABLE
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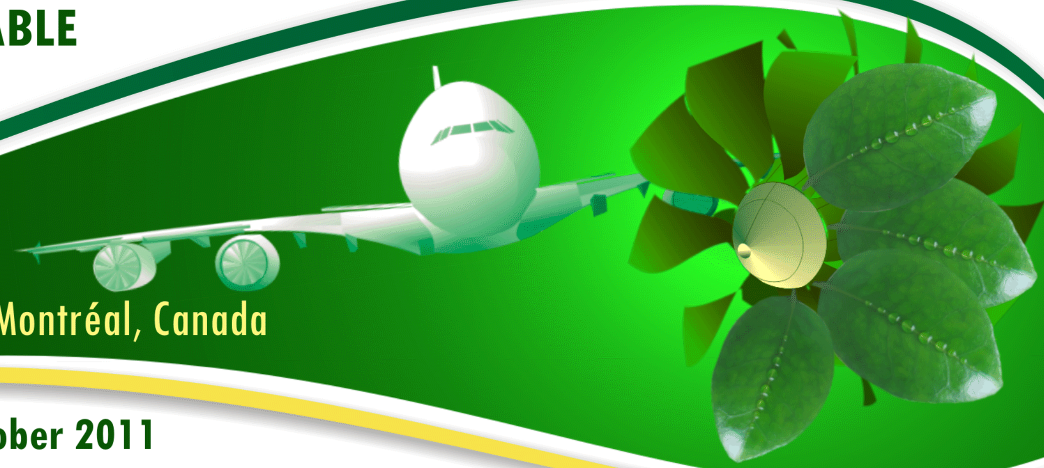


ICAO Headquarters, Montréal, Canada

18 to 20 October 2011

Volatility in Biofuels Market

High volatility in biofuels market

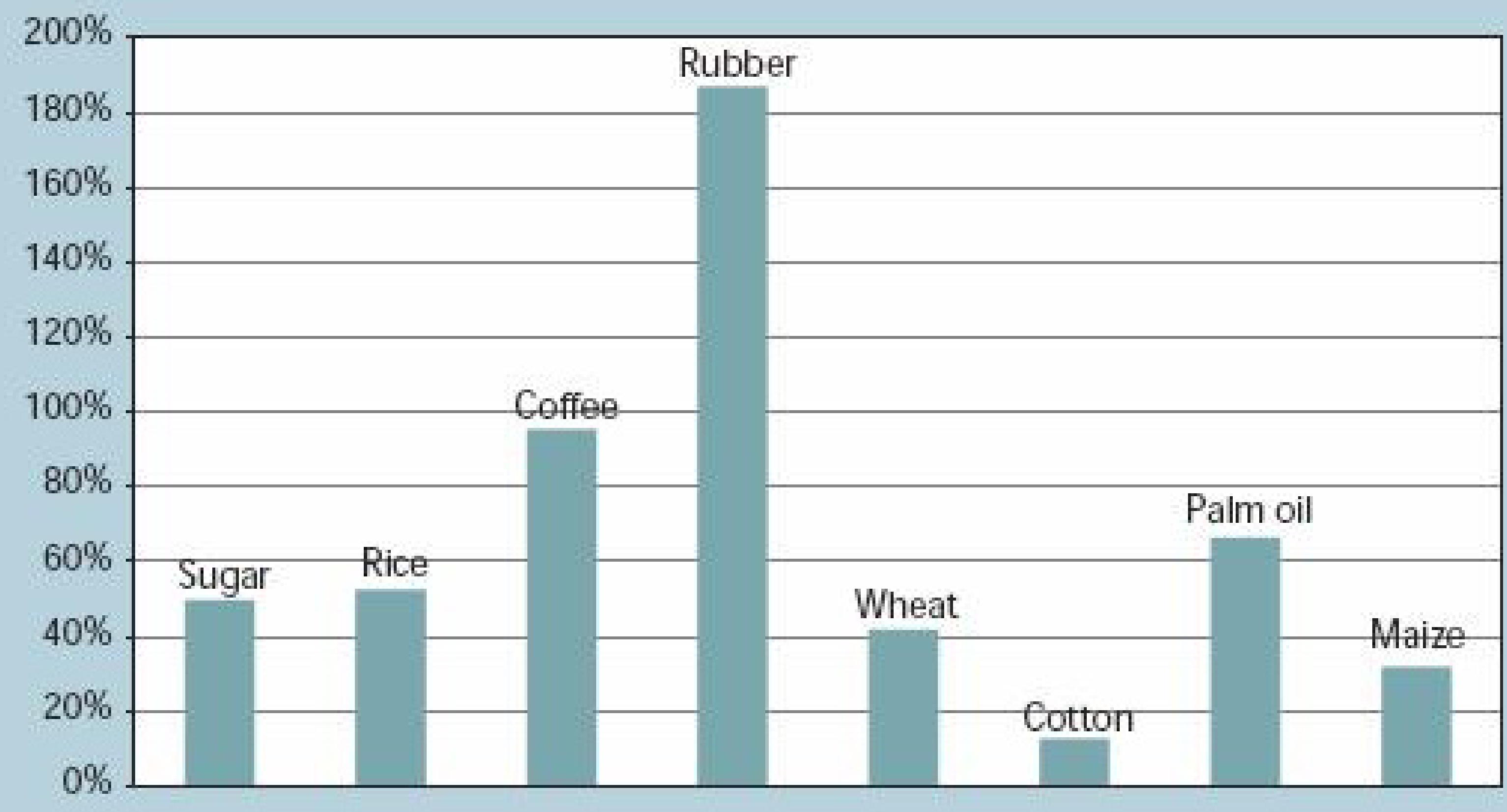
- Rising commodity and food prices
- Fluctuating demand for biofuels
- Volatility is amplified:
  - Increasing interconnectedness between energy and commodity markets
  - Risk for biofuels producer and commodity producer alike is linked to two markets
- Increased speculation

Volatility increase in commodity markets - Zulauf and Roberts (2008)

	Corn	Soybean & Wheat
1989-2003:	25%	15%
2003-2007:	35%	20%

- First-generation biofuels like bio-ethanol and biodiesel rely on commodities such as sugar cane, corn or rapeseed,
- Energy producers compete directly with animal-feeding operations and food processors for their respective commodities

Figure 10. Percentage change in various commodity prices, 2001/02 to 2006/07 (adjusted for inflation)



Source of raw data: IMF (2008).

It is not all biofuels…..

- Higher oil prices lead to higher costs of food production which lead to higher food prices even in the absence of a demand for biofuels
- Demand for maize is increasing independently of its use as a feedstock for ethanol
  - Improving economic conditions in developing countries: Shifting diets away from cereals toward livestock products. These use substantial quantities of maize as feed.
  - Several calories of grain to produce just one calorie of meat
  - An increased demand for meat means a substantially increased demand for grain
- Exchange rate movement: Ex. A weakening of the US dollar will lead to a shift in supply and demand and cause increases in commodity prices
- Inventory: Low level of cereal stocks create more uncertainty and make the markets more susceptible to supply shocks
  - Attract Speculative Investors which exacerbate the uncertainty
  - Increased price volatility in the short term

Oil prices are unstable

- Empirical evidence shows that oil prices exhibit greater volatility than cereal prices at both monthly and annual frequencies
- The relative lack of integration between oil markets and agricultural commodity markets in years past meant that fluctuations in oil prices had relatively little effect on food price instability.
- This is no more the case now.

Table 1. Volatility of real (inflation-adjusted) commodity prices, 1990 to 2007 (percent)

Commodity	Annual		Monthly	
	CV	DLMA	CV	DLMA
Petroleum	47	21	46	19
Sugar	29	20	33	19
Rice	24	14	25	11
Wheat	21	15	24	14
Maize	22	14	24	13
Palm oil	28	25	30	20
Soybean oil	21	16	22	14
Sunflower oil	24	21	24	17
Sorghum	19	13	22	13
Rubber	37	26	36	19

Note: CV is the coefficient of variation. DLMA is the average absolute value (over time) of the percentage change in the annual or monthly price from a two-year lagged moving average.

Source of raw data is IMF (2008).

Demand for biofuels dependent on crude oil prices

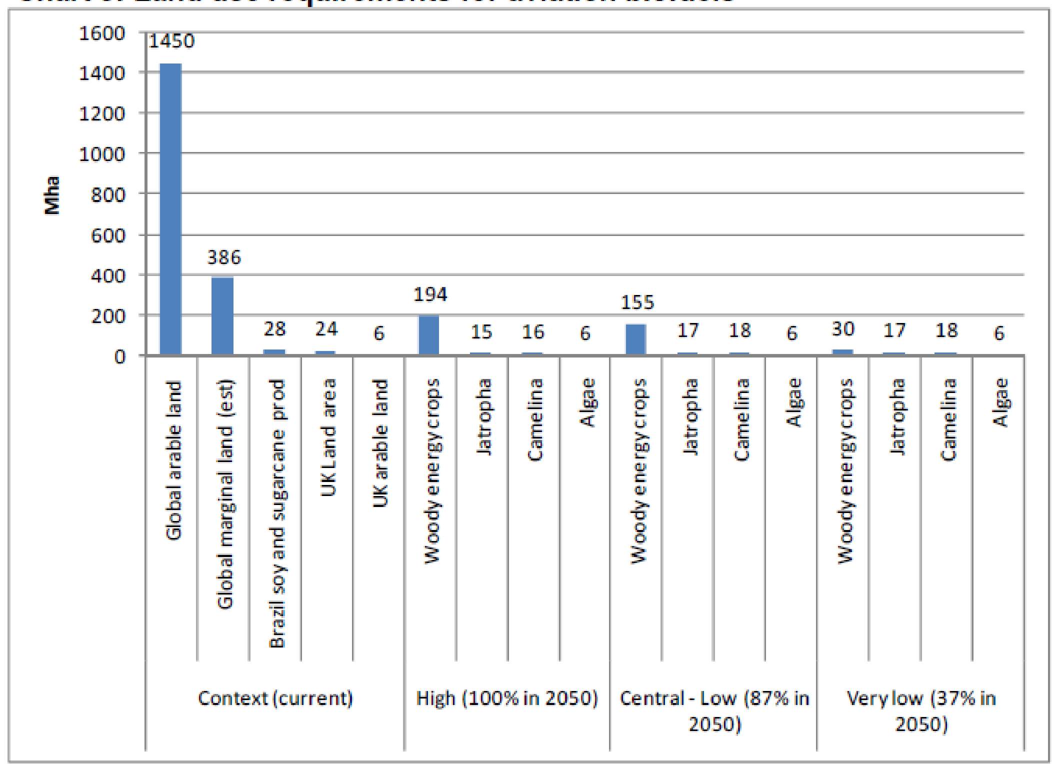
- High oil prices: Biofuels can compete and accordingly demand for biofuels is high
- Low crude oil prices: Decline in demand for biofuels, i.e. demand for biofuels is highly sensitive to overall market conditions: “The recent economic crisis led to a decline of oil prices and reduced the demand for first-generation biofuels, affecting various production facilities.”
- FAO believes crude oil prices will drive biofuels prices and, in turn, influence agricultural commodity prices
- Greater integration between oil prices and agricultural commodity prices is likely to result in more pronounced price instability for cereal grains.

Land use impact of biofuels, E4Tech Study(2009)

Full replacement of Jet kerosene by 2050 would require:

- 37 million hectares for new oil crops (Camelina, Jatropha, Algae)
- 194 million hectares for woody energy crops (for BTL),
- Total: 231 million hectares.

Chart 3: Land use requirements for aviation biofuels



Source: E4Tech for the UK Climate Change Committee, 2009.

Land use impact of biofuels

- 231 million hectares represent 16% of all arable land
- Estimated 386 million hectares of marginal land around the world
- However, Jatropha and Camelina yields would be higher on arable land so there is a potential pressure on food crops.
- Expected rise in the world population from 6.5 billion to 9 billion by 2050 could mean a reduction in the amount of arable land required for food production by 2050.
- Meeting these challenges will require instruments such as sustainability standards or planning regulation

Marginal land – marginal yields

- Promise of second and third generation biofuels – no competition for land and water needed for food production, and a greater contribution to energy security
- However, crop residues have some value:
  - A sizable fraction are usually returned to the soil to manage organic matter and soil fertility.
  - Some crop residues are used as animal feed
  - In low-income developing countries, they are burned as fuel.
- Jatropha and other oil-bearing, non-food shrubs that can grow on marginal land with little rainfall.
- However, questions about possible yields and required inputs and about the economics of growing these perennial poisonous shrubs for fuel production remain.
- BP and D1 Oils Jatropha Project: In April 2009, D1 Oils reported that, when Jatropha is grown on arid and infertile soil, the oil yields are too low to be economic: “If you grow Jatropha in marginal conditions, you can expect marginal yields.”

E4Tech Study Conclusion

- *"Biofuels could supply between 35 and 100% of global jet fuel demand in 2050, with potential for high greenhouse gas savings, provided that the risk of land use change from the production of feedstocks is managed effectively"*

Elobio: An analysis of biofuel-related risks and their impact on project financing (April 2010)

- **Technology risk**: Relevant for new technologies which have a short or even no track-record in large-scale production installations producing a product of consistent quality for longer period of time.
- **Market risk:** Mainly refers to fluctuations of the feedstock and biofuel prices and the correlation between the two or lack of it.
- **Regulatory risk**: As most biofuel production still requires policy support it is important whether investors and lenders consider this support as adequate and stable, or insufficient and unreliable.
- **Geopolitical risk:** Relevant for production based on feedstock from regions with an unstable political environment where export taxes or bans can be adopted without sufficient prior notice.
- **Stakeholder acceptance risk**: Refers to the negative publicity received by biofuels during the food crisis of 2007/2008, which was seen as real threat to the reputation of finance providers who could be associated to biofuel production and has caused some lenders to categorically deny funding to any kind of biofuel projects.

First and second generation biofuels clearly exhibit very different risk profiles

Table 3: Risk profile of first and second generation biofuels

Risk Type	*1st generation*	*2nd generation*
Technology risk	Low-medium	High
Market risk	High	Medium
Regulatory/Policy risk	High	Medium
Geopolitical risk	Medium	Low
Stakeholder acceptance	High[5]	Low

Technology risks

- Technologies for second generation biofuels still at demonstration stage. Many uncertainties persist
- Capital providers see technology risks related to investments in second generation production facilities as “high,”
- This not only deters risk-averse banks but even private equity.
- Zider (1998) points out, “betting on a technology risk in an unproven market segment is something even venture capital would avoid.”

Technology risks

- Technologies are capital intensive and have long lead times
- Capital intensity of energy technologies is one of the main investment barriers mentioned by several venture capitalists.
- “Biomass production development likely to be a bottle-neck”
- “Strong expectations on algae, but still requiring research and confirmation”
- From an investor’s point of view, there is not much that can be done to mitigate technology risk.

Market risk- first generation biofuels

- High market risk for first generation biofuels because they use foodstuffs as their main feedstock, which can have high price volatility.
- Food price shock of 2008: Risk escalated when several biofuel producers had to drastically cut down production or even shut down their operation completely
  - Feedstock has become so expensive
  - Price of biofuel did not always follow the rise of production costs, making it uneconomical.

Market risk- second generation biofuels

- Possible feedstocks cover a wide range of cheap nonfood crops, residues and waste products, often with a negative price
- The market risk related to second generation biofuels has less to do with prices and more to do with quantities (at least initially)
- Risks associated with provision of sufficient feedstock quantities.
- IEA Bioenergy, 2009 : Economical second generation biomass-to-liquid (BTL) plants will need to be very large – scale requiring around a million tonnes of dry biomass a year to be economically viable
- Market risk is medium as perceived by investors
  - Logistical difficulties and possible future increases in feedstock price

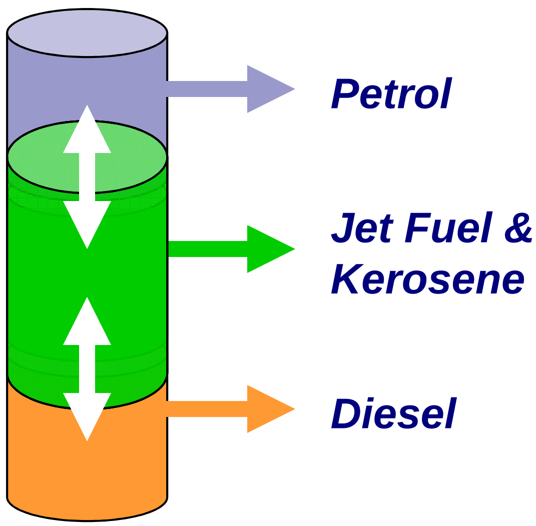
Competing products – A risk

- ❑Refineries are run on spreads between prices of related products

- ❑Optimize product mix to maximize gains

- ❑Integrated biorefineries are similar to conventional refineries in that they produce a range of products to optimize both the use of the feedstock and production economics

- ❑Similar scenario where airlines may not get all the biojet they need?



Risk mitigation

- Investing in a multi-feedstock plant
- Hedging and securing long-term contracts can increase price predictability, at least for the short to middle term.
- The biorefinery concept maximizes the use of the biomass resource and brings revenue from different markets, lowering the risk of a slump in one of them.
- Although market risk remains high, these mitigation options make it less uncontrollable and thus a lesser issue compared to technology risk.

Summary

- Airlines highly sensitive to fuel price – As much as they would like to embrace sustainable aviation fuels, these have to make sense to the bottom-line
- First and second generation technologies have very different risk profiles, which translate to different costs of capital for biofuel projects employing more established or newer technologies.
- Higher perceived risks will result in higher cost of capital. This influences the rate of market deployment and consequently affects their technological learning curve and further cost reductions.
- Mitigation measures like price hedging and investment in multi feedstock plants
- Advocate a regional approach to supply and distribution of sustainable aviation fuels focusing on areas where price gap is limited

List of references

1. The new "gold rush": biofuels developments in Asia and the Pacific region (FAO, 2008)
2. Agricultural Commodity Support and Biofuels Policy,(Joseph Cooper, July 18, 2011)
3. Handling Volatility: A simple model for hedging in the biofuels market, (Martin Ziegelbäck, hedging.eu)
4. US Biofuels Analysis Under Uncertainty and Volatility in the Biofuels Industry:FAPRI Stochastic Modeling (“Biofuels, Food and Feed Tradeoffs” Farm Foundation,12-13 April 2007,Saint Louis, Missouri)
5. Bringing aviation biofuels to market in sufficient scale (IATA Alternative Fuels Report 2009)
6. Commodity Price Volatility in the Biofuel Era: An Examination of the Linkage between Energy and Agricultural Markets (Thomas W. Hertel*and Jayson Beckman GTAP Working Paper No. 60,2010)
7. Price Volatility in Food and Agricultural Markets: Policy Responses. (FAO, IFAD, IMF,OECD, UNCTAD, WFP, the World Bank, the WTO, IFPRI and the UN HLTF, 3 May 2011)
8. Overcoming the initial investment hurdle for advanced biofuels: An analysis of biofuel-related risks and their impact on project financing (Report D7.1 of ELOBIO subtask 7)
9. Assessment of Biofuels Potential and Limitations (Feb 2010 Report commissioned by IEF: Claude Mandil ,Adnan Shihab-Eldin)
10. Liquid Biofuels: Background Brief for the World Bank Group Energy Sector Strategy (Background Paper for the World Bank Group Energy sector strategy, March 2010)

THANK YOU

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