World Biodiesel Viability Amidst High Feedstock Prices

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ABSTRACT

Conventional economics says the price of crude palm oil (CPO) has an inverse relationship with stock. In the past two years, however, the economics of world oils and fats had changed, resulting in both prices and stocks rising in tandem, thus defying traditional economic theory. There are now strong signs of a linkage between the fuel price and the CPO price, which is created by the new role played by biodiesel. The article suggests that, when analysing the palm oil price, one now has to take into account of two factors, namely the petroleum price and the level of oil stocks. The petroleum price determines the price band within which palm oil will trade, while the stock level determines how high or low palm oil prices will lie within the trading range.

Once upon a time (it now seems long ago!), you could explain crude palm oil (CPO) price levels very effectively in terms of movements in palm oil stocks. Higher stocks meant lower prices, and *vice versa*. Then, a Fairy Godmother appeared (at least, it was one from the perspective of producers). Biodiesel users did not ask whether vegetable oil stocks were high or low; they merely looked at crude petroleum prices and government subsidies and incentives, and decided whether to buy biodiesel – and how much to buy. As long as petroleum prices were high and subsidies and incentives were strong, biodiesel demand was wonderful for producers. Prices went on rising, and people started to think that nothing could stop them from going further, to RM 3000, RM 4000, and even RM 5000. Then, the users started to ask: would they make money making biodiesel blends? Biodiesel manufacturers also started to cut back output.

Moral: Don't forget that a margin business needs positive margins to survive.

Going back a few years (*Figure 1*), we see that, prior to 2002, vegetable oil prices were not significantly related to fuel prices. In fact, the statistical correlation between vegetable oil and fuel prices was negative: in most instances, when fuel prices rose, vegetable oil prices tended to fall. After fuel prices started to soar in 2002, the world changed. Vegetable oil prices, led initially by rapeseed oil (over a quarter of the world output for this oil is now used for biofuels) but now including all major oils, have become more closely linked to fuel prices.

In *Figures 2* and *3*, I plot a series of rolling 12-month correlations between the monthly prices of selected oil products and fuel prices. In *Figures 2* and *3*, the December 2007 value is the correlation over the 12 months from January to December 2007. The January

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2008 correlation is for the period from February 2007 to January 2008, and so on, moving the 12-month period one month forward each time. *Figures* 2 and 3 show that rapeseed oil price led other vegetable oil prices in tracking the fuel price. Since April 2007, it is clear that other vegetable oil prices joined rapeseed oil prices to move in tandem with fuel prices.

The prices of vegetable oils do not always move together, because differentials fluctuate. Harvest problems or changes in import tariffs (*e.g.*, those in India that lifted the CPO discount on soya oil after 2001) are important. In the past 24 months, however, monthly prices of different oils and fats have become more closely linked than ever before. The biofuel boom is undoubtedly the major factor behind this transformation.

The high correlations between monthly prices of vegetable oils and animal fats leave no doubt that the changes in prices throughout the whole spectrum of products are now very closely linked to changes in Brent crude oil prices. In broad terms, a given change in fossil fuel prices is transmitted directly throughout the oil and fat market.

The question I would like to pose is: *Does the convergence between price changes for fossil fuels and for different oils and fats signal a new era for vegetable oil prices?*

Looking ahead, the evidence may seem ambiguous; there is good reason to think that the prices of crops used for biofuels will, in future, be linked to fuel prices, but the evidence of a general commodity bull market in the past few months suggests that there is also speculative 'froth' that occasionally infects commodity prices, and this should not be considered to represent normal behaviour.

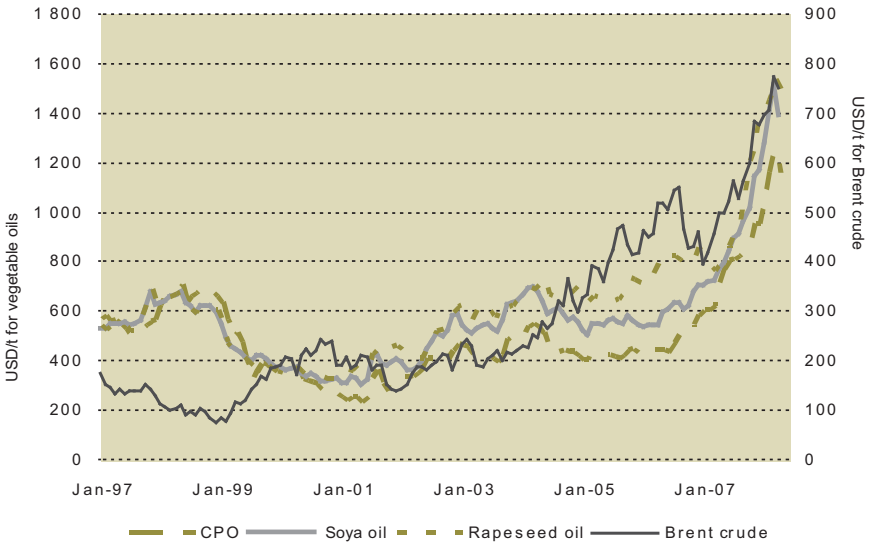

Figure 1. Price behaviour of vegetable oils and Brent crude petroleum.

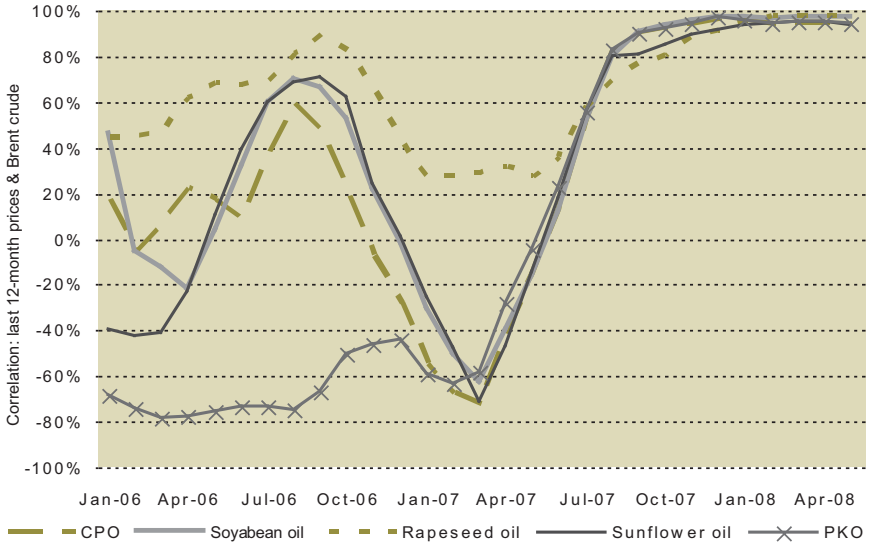

Figure 2. Rolling 12-month price correlations of leading vegetable oils with Brent crude petroleum.

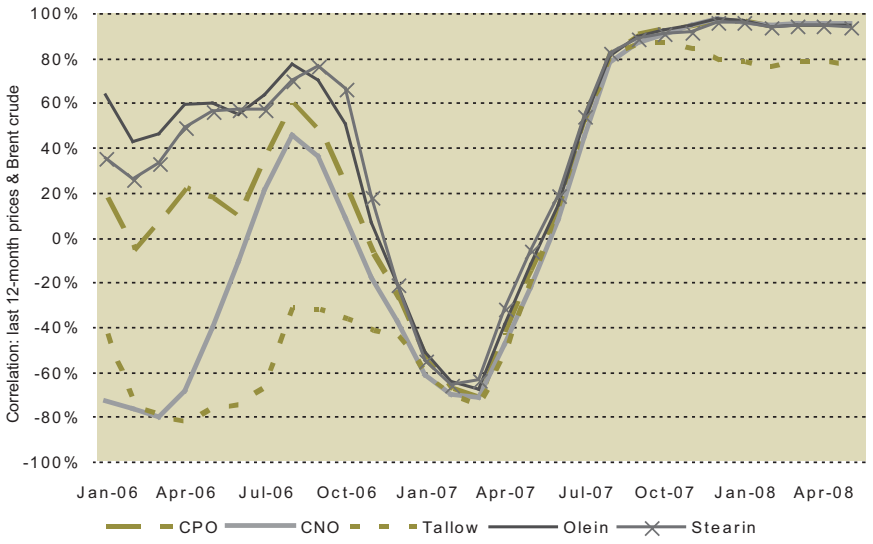

Figure 3. Rolling 12-month price correlations of other vegetable oils with Brent crude petroleum.

Nevertheless, under current policies, biofuel demand is now so important for vegetable oils as a whole that the fuel price link will remain, even when fuel prices drop back.

Why is there this close price link? The answer is that biofuel policies in many countries do not insist upon the use of biofuels without regard to the economics of their use.

In the world's two main biodiesel markets, the European Union (EU) and US, biodiesel demand is supported by a mixture of policies: tax incentives, targets, penalties for failing to achieve targets and direct mandates. It is only with mandates that the demand for biodiesel is given, and is completely unaffected by the level of fossil fuel prices. With all other policies, a drop in fossil diesel prices is translated directly into a drop in the price that blenders are prepared to pay for biodiesel, and hence pay for vegetable oils.

Figure 4 depicts how EU policy created price-sensitive ranges of demand for vegetable oils used for biodiesel in 2007. In this figure, I have taken the specific example of a North Sea Brent crude oil price of USD 100 per barrel and have ranked the 27 EU member states in decreasing order, in terms of the incentives that their governments provide (either in a positive manner, via reduced fuel taxes, or via negative incentives, in the form of penalties to buy out blending obligations).

For each EU member state, I have computed its target volume of biodiesel use in 2007. The last stage in the construction of the figure is to calculate the Southeast Asian CPO price which, once processing and shipping costs and import tariffs are included, would represent a break-even price for Malaysian biodiesel producers in each country when the Brent crude price is USD 100 per barrel.

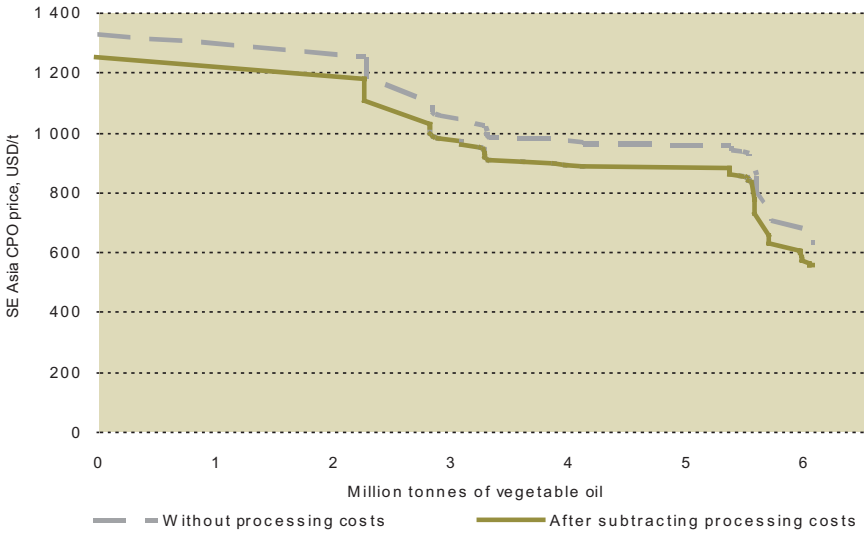

Figure 4. Building a demand curve in 2007 for vegetable oil (in terms of Malaysian CPO prices) in the EU biodiesel market at USD 100/bbl. Brent crude oil.

The figure implies that in 2007 over two million tonnes of palm methyl ester (PME) could have been sold profitably for blending with fossil diesel at a CPO price of over USD 1200/t and Brent crude price of USD 100. As the CPO price dropped below USD 900, the potentially profitable market for PME would have been in excess of five million tonnes.

In practice, PME had to compete with other methyl esters for this market, but *Figure 4* demonstrates that biodiesel policies last year created a sizeable volume of demand for oil for biofuels that was very sensitive to the vegetable oil price. This demand tended to keep the CPO price within a fairly narrow price range linked to Brent crude.

In the EU, the leading national market for biodiesel, that in Germany, illustrates the complexity of the real world. The biodiesel sector has two separate segments. One – to meet the official biodiesel B5 target blend – allows blenders the option of paying a penalty to buy out their blending obligation, but the penalty is so high that the B5 blend target is always met.

The other market segment – the sale of B100 biodiesel fuel for heavy transport vehicles – has, since August 2006, paid a gradually increasing level of fuel taxation, which has risen to the equivalent to 17.5 US cents per litre in 2008 and is due to be raised again in January 2009.

This specific B100 tax inevitably reduces the profitability of such B100 sales, as well as the sales of vegetable oils for direct use in diesel engines. *Figure 5* illustrates how monthly sales of B100 and direct use of pure vegetable oils collapsed when the tax on these fuels was last increased at the start of 2008.

Rapeseed methyl ester enjoys a premium over other forms of biodiesel in the EU market and is particularly well placed for biodiesel sales at times of the year when winter fuel standards apply and FAME-20 is the only methyl ester permitted for use in northerly regions of Europe.

Nevertheless, *Figure 6* reveals that crude rapeseed oil prices rose to the point where biodiesel margins on B5 sales in late 2007 fell so low that, once the biodiesel processing costs are added to rapeseed oil prices, processors could not cover their full costs. For the B100 sales, the processors'

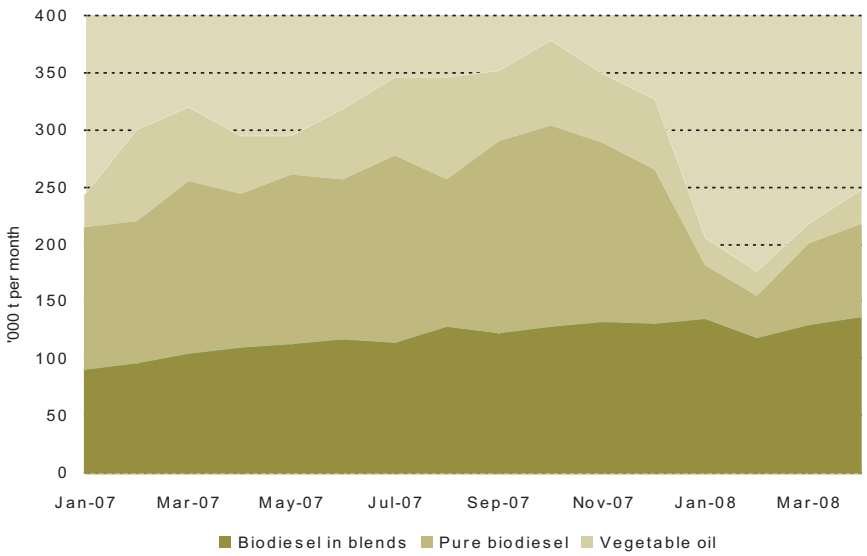

Figure 5. German monthly use of vegetable oil-based fuels.

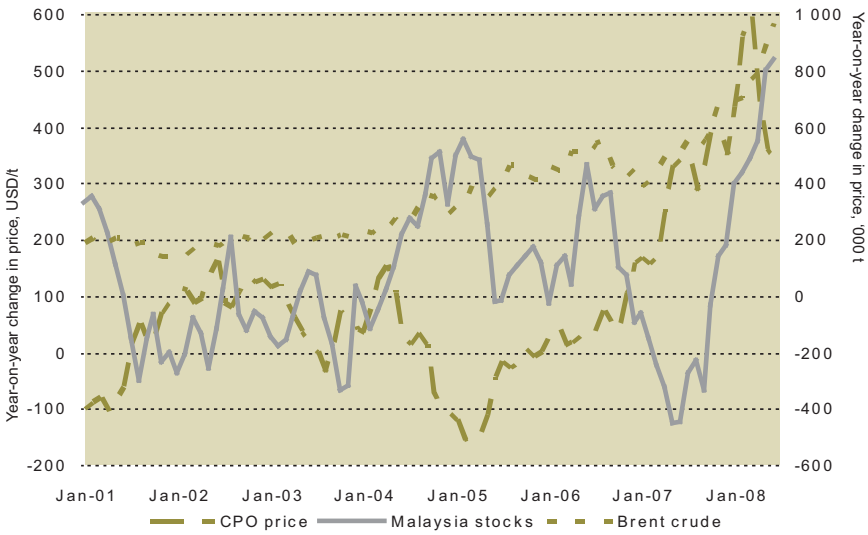

Figure 6. German gross margins on B5 and B100 production from crude rapeseed oil vs. *use of vegetable oil-based fuels.*

average gross margin (the difference between the B100 sales price and the price of crude rapeseed oil) was actually negative for nine months from mid 2007.

The overall biodiesel picture is made more complicated by the actions of governments in countries exporting biodiesel. For example, the US government provides blending credits of USD 1/gallon (over USD 300/t) on all biodiesel blended with fossil diesel. This is given on all blends, both exported, as well as for local use, and has led to a surge in imports of biodiesel for blending with 1% fossil diesel for re-export as B99, with the benefit of the blending credit, and has also led to a boom in blending US-produced biodiesel with fossil diesel for export as B99. Most of the exports go to the EU, where biodiesel enjoys a further subsidy.

US net exports of biodiesel have recently been over 75% of local production, *i.e.*, close to 150 000 t per month *vs.* almost 200 000 t of output. As the same time, US biodiesel imports have also been growing. Recently, they have been well over half of local production, peaking at more than 125 000 t in one month. Most imports used to be of PME from Southeast Asia, but South American supplies are steadily becoming larger, notably from Argentina.

Until the slump in vegetable oil prices after mid 2008, US biodiesel producers faced growing pressure on two fronts in their local sales. Their product was increasingly expensive *vs.* fossil diesel, which restricted its ability to sell in the domestic market. At the same time, RBD soya oil prices were so high that net processing margins were negative (*Figure 7*). This meant that *splash and dash* exports – whereby a 'splash' of fossil diesel is added to biodiesel to secure the USD 1/gallon blending credit – became vital to US biodiesel producers for their short-term survival.

While US and EU biodiesel processing margins were hit by high vegetable oil prices, new exporters were emerging with subsidized biodiesel exports, alongside the existing 'splash and dash' US exports. The export subsidies are contrasted in *Figure 8*.

Both Argentina and Indonesia apply lower differential export taxes (DETs) on biodiesel than they do on vegetable oil. In Argentina, soya oil exports pay a tax of 32%, while biodiesel exports pay a net export tax on biodiesel just 2.5%. This gave Argentine biodiesel exporters an advantage of close to USD 380/t in July 2008. Indonesian RBD olein in August 2008 is paying an export tax of 15%, while biodiesel pays a 5% export tax. This gives local processors a current biodiesel export subsidy of around USD 110/t. Both were also able to 'double-dip' by shipping to the US and then claiming the US 'splash and dash' subsidy of USD 300/t, creating a veritable merry-go-round in the global biodiesel market.

What does this surging demand for biodiesel and the new links between vegetable oil and mineral

oil prices mean for the behaviour of world vegetable oil prices?

The nice inverse relationship between year-on-year MPOB palm oil stock changes and local CPO price changes that prevailed for years, as may be seen from *Figure 9*, has been shaken since 2006. I have therefore taken the advice of the great economist, JM Keynes who said: "*When the facts change, I change my mind*".

Two years ago, there was no statistical link between fuel and CPO prices. Looking back today, we see we can identify when the impact of fuel prices started to make itself felt. Some time near the start of 2006, increases in stocks were not associated with declines in palm oil prices. Instead, both stocks and prices moved ahead, leading to the unexpected situation in which MPOB reported palm oil stocks were at their all-time high at the end of June 2008, and yet prices were also at their peak. This is not what conventional economics would lead one to expect.

The explanation is that petroleum has become part of the equation (as is evident from *Figure 10*), thanks entirely to the biofuel link. As biofuel demand for vegetable oil switches on and off at short notice in response to changes in the differentials between petroleum and vegetable oil prices, one now has to take account of two factors when trying to analyse palm oil prices: the petroleum price and the level of stocks. The former determines the price band within which palm oil will trade; the latter determines how high or low palm oil prices will lie within the trading range.

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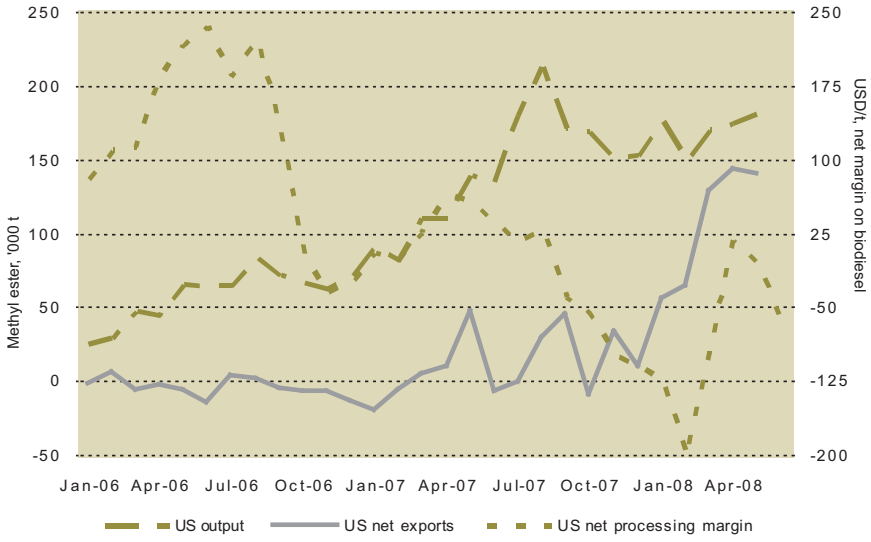

Figure 7. US output and net exports of biodiesel vs. *net processing margins on RBD soyabean oil.*

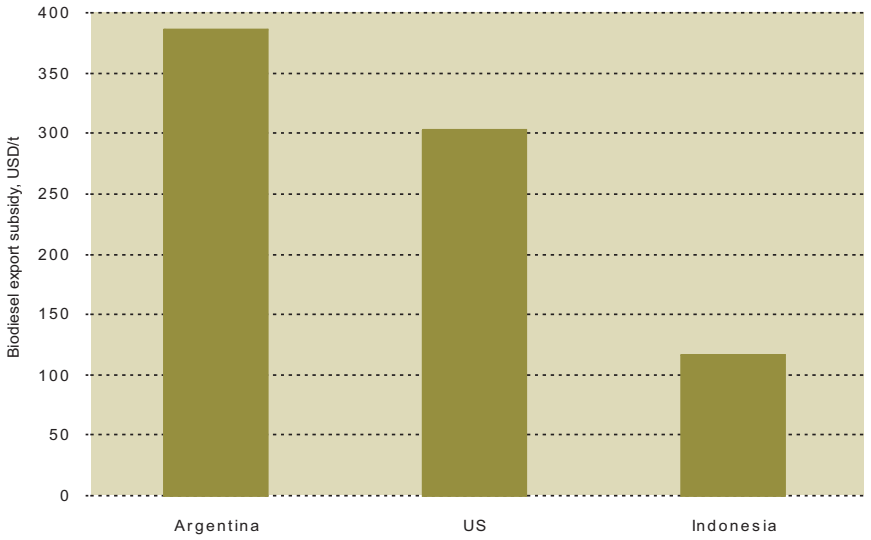

Figure 8. Subsidies on biodiesel exports, August 2008.

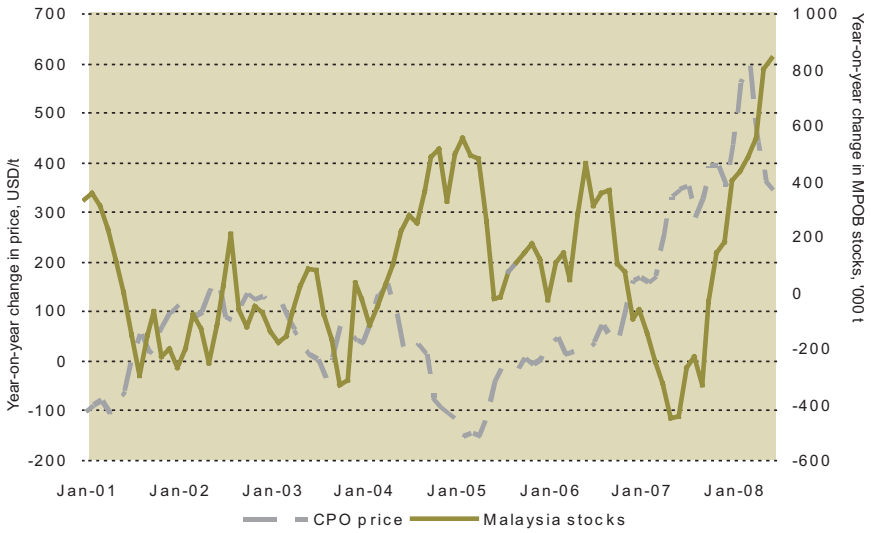

Figure 9. Year-on-year changes in Malaysian stocks vs. *changes in CPO prices.*

World, Public Ledger, UFOP (Germany), the US Departments of Agriculture and of Energy, and the World Bank.

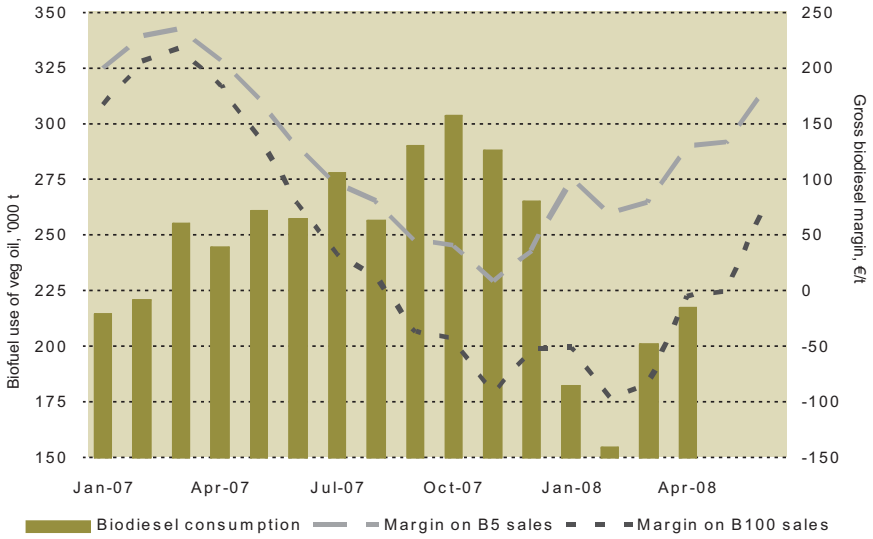

Figure 10. Contrasting Brent crude oil prices with year-on-year changes in Malaysian stocks and the changes in CPO prices.