Do Futures Prices = the Future Price?

Some research evidence

By John Robertson

Reading time: 4-8 mins

There is a good deal of evidence that current futures prices are not a good guide to spot prices in the future.

In talking about his company's bid for Alcan, Rio Tinto chief executive, Tom Albanese, recently sought to persuade analysts that they were getting the outlook for the aluminium market wrong.

In a presentation on 2 August, he used a **chart** (shown below) to contrast the price forecasts of analysts with the forward prices then prevailing in futures markets.

At the time of the presentation, analysts were forecasting a 2010 aluminium price of 92 US cents per pound, while the futures markets were trading aluminium for delivery in 2010 at 117 US cents per pound.

This, according to Albanese, was evidence of analysts being too pessimistic about the outlook. In his view, their pessimism affected the valuation being ascribed to Rio Tinto and the level of enthusiasm being shown for the Alcan transaction, which had left some sceptical about the extent to which it might add value for shareholders.

Theoretical connection

In a normal market, the forward price of a commodity, such as aluminium, should simply reflect the cost of financing and storing the metal. This would allow a purchaser of metal for use at a later time to proceed in one of two ways:

1. buy the metal now at the spot price and pay the financing or storage costs for as long as it takes before he needs to use it; or
2. enter a contract to take delivery of the metal at some future date when it might be needed.

In opting for the latter course, he should be prepared to pay more than the spot price, but no more than the cost of buying today and financing the storage.

Reflecting this, the forward price for a commodity should trade at a premium – a contango – to the spot price. The forward price of a commodity T years ahead which has a current spot price of S_0 and which provides no income will be:

$$F_0 = S_0 e^{rT}$$

where r is the annual financing and storage cost.

However, markets do not always operate in such a disciplined manner. Supply shortages, for example, might make it difficult for a trader to make good his contract to deliver metal when the time comes and he might have to bid up the spot price to fulfil his contractual obligation.

If market traders expect current shortages to ease over time, the spot price might actually exceed forward prices. This so-called backwardation is regarded as abnormal, but can persist for lengthy periods.

Future spot price outcomes will depend on changes to the availability of the commodity when it is needed.

Underpinning the use of futures prices in the way implied by Rio Tinto is a relationship which can be expressed as:

$$S_{t+k} = \alpha + \beta F_t + \varepsilon_{t+k}$$

in which S_{t+k} is the spot price for a commodity k periods ahead and F_t is the current futures price for a commodity to be delivered k periods ahead.

For the Rio Tinto inference about the connection between futures prices and spot prices to hold, α must equal zero and β must equal one. Even then, S_{t+k} does not necessarily equal F_t. That depends on the distribution of ε_{t+k}, the error term.

Most often, analysts assume that ε has a normal distribution. In that case, when $\alpha = 0$ and $\beta = 1$, the formula implies that the forward price is an unbiased estimator of the future spot price.

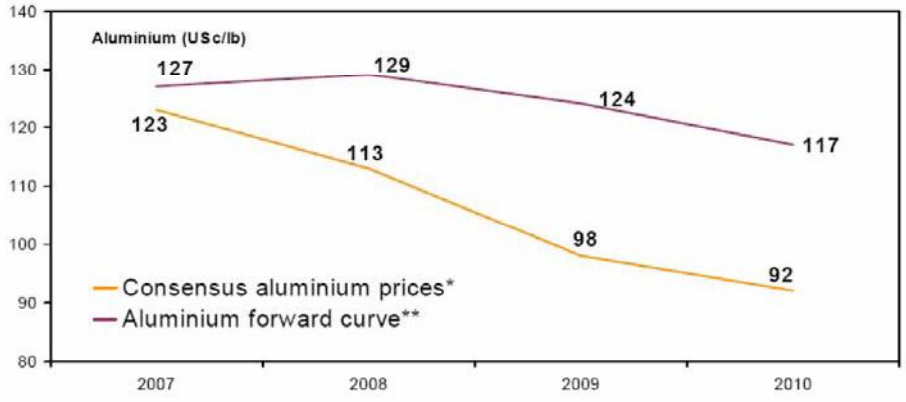
At face value, an 'unbiased' estimate sounds like it might be worth having. However, being unbiased simply means that the average forecasting error will tend to zero.

Any single unbiased forecast might be a very large overestimate or underestimate of the actual outcome, as long as one inaccurate forecast is offset by one or more equally inaccurate forecasts in the opposite direction.

As a forecaster, my forecasts could be unbiased, but consistently inaccurate by a large margin.

This is not an especially comforting characterisation for an investor putting his wealth at risk based on my advice.

Divergence between analyst consensus and metal market



Source: Rio Tinto Limted

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Empirical evidence

In any case, there is some doubt at an empirical level about whether the relationship described in the equation actually holds.

Because of its macroeconomic importance, many studies have used spot and futures prices in the oil market to investigate the relationship.

One study which throws some light on the relationship was reported in the December 2005 edition of the *Federal Reserve Board of San Francisco Economic Letter*. Researchers Tau Wu and Andrew McCallum modeled oil prices using four approaches:

1. a random walk model which predicted that spot prices will stay at their current levels;
2. a model which predicted that the future oil price will be the current spot price adjusted for the interest rate;
3. a futures model which predicted an oil price level in the future identical to the current futures price level; and
4. a futures-spot spread model which used the spread between the current futures price and the spot price to predict movements in the future price of oil.

The researchers evaluated model performance by using:

- measures of the best fit over the full data set from the mid 1980s to late 2005; and
- measures of out of sample forecasting errors.

Wu and McCallum found that raw futures prices are unbiased predictors of future oil prices in so far as futures prices are just as likely to over predict as under predict future oil prices. However, they noted that the absolute level of the errors was quite large.

They found that the best model for forecasting was the *futures-spot spread* model. However, the researchers noted here that this model failed to offer acceptable levels of accuracy.

For example, in December 2005 they could only say with 90% accuracy that the spot price in March 2006 would be between $55 and $74 per barrel. At the time of the forecast, the spot price was $62 per barrel. The actual average March 2006 price was $61 per barrel.

Another study along similar lines, *Forecasting Commodity Prices: Futures Versus Judgment,* had previously been undertaken by Chakriya Bowman and Aasim Husain and published in a March 2004 International Monetary Fund working paper (WP/04/41). The authors attempted to assess the performance of three types of commodity price forecasts based on:

- analytical judgment including quantitative and qualitative analysis of factors thought to determine the level of commodity prices;
- statistical models of historical price data; and
- the prices implied by commodity futures when models attempt to use futures price information in combination with historical price data.

Bowman and Husain found that models incorporating futures prices generally yielded superior forecasts over horizons of one year or longer.

Their analysis covered 15 primary commodities including six industrial metals and nine agricultural products. For 13 of the 15 commodity prices, models incorporating futures prices "produce forecasts that are at least as good as – and in most cases better than – forecasts that do not explicitly incorporate futures, including judgmental forecasts, at the eight-quarter horizon".

Another study focusing on the effectiveness of oil price forecasting models was published earlier this year[1]. The authors noted that "the empirical literature is very far from any consensus about the appropriate model for oil price forecasting that should be implemented. Findings vary across models, time periods and data frequencies".

This study also finds support for the hypothesis that futures prices are unbiased predictors of spot prices. The study also finds that futures prices offered forecasting advantages only when admitted in a more complex relationship than the simple linear model implied by the Rio Tinto approach. It finds that using levels "does not produce satisfactory forecasts".

A paper presented in August to the Federal Bank of St Louis *Applied Econometrics and Forecasting in Macroeconomics and Finance Workshop*[2] offered some new evidence on this topic. The results presented were preliminary and subject to revision, but worth highlighting for the new perspective thrown on the previous work done.

The authors found that the ability of futures prices to forecast spot prices is limited to only certain circumstances. Their empirical analysis actually suggested that "prices of crude oil futures are not useful predictors of the spot price of crude oil in practice" due to the presence of a large and time varying risk premium.

Not much value?

The upshot of this review is that one needs to be very careful about what inferences are drawn from current futures prices about the direction of spot prices in the future.

On their own, futures prices appear to be of little value. There is some evidence supporting the usefulness of futures prices in combination with other data in forecasting.

However, the conclusions about the informational content of futures prices are so heavily qualified as to render the value of futures prices as predictors in investment decision making highly doubtful.

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1 Longo, C., Manera, M., Markandya, A. and Scarpa, E., 2007, 'Evaluating the Empirical Performance of Alternative Econometric Models for Oil Price Forecasting', Fondazione Eni Enrico Mattei Working Paper, January.

2 Kilian, L., 2007, 'What do We Learn from the Price of Oil Futures', 16-17 August.