Risk-adjusted forecasts of oil prices

By Patrizio Pagaon and Massimiliano Pisani

Discussant: Brian Torgunrud, Finance Canada

July 10, 2006

- Good afternoon.
- Thank you for opportunity to be here today and to comment on this paper. I found it to be a very interesting and well-written piece, and one which gives us some valuable insight into futures prices and their role in commodity price forecasting.
- By way of overview to my comments, I will first provide a brief summary of what I saw as the key findings of the paper. Then I'll turn to a few issues related to the intuition underlying the work, as well as a few comments of a technical nature.
- Finally I would like to try to provide a little context from our perspective on the bigger picture of futures prices and economic forecasting.

Key Findings

- **Oil price forecasts using oil futures generate a systematic negative forecast error.**
- **Real-time business cycle indicators (e.g. capacity utilization) can help explain this error.**
- **Relationship between capacity utilization and forecast errors improved after 1996, corresponding to a drop in inventory levels.**
- **Risk-adjusted futures forecasts outperform random walk, unadjusted futures and “constant-adjusted” forecasts.**

2

- The paper applies the methodology of Piazzesi and Swanson (2004) for Fed fund futures forecasts to oil prices, with the following results:
- Oil price forecasts using oil futures generate a systematic negative forecast error.
- Real-time business cycle indicators – in this case U.S. capacity utilization – can help explain this error, and allow for the identification of a “risk premium”. This is defined by the authors as that part of the forecast error which can be explained by changes in U.S. capacity utilization, and the adjusted forecast considered to be “risk-adjusted”.
- The authors find that the relationship between capacity utilization and forecast errors has improved since 1996, which is attributed to a move toward lower inventory holdings during the 1990s. After testing for the existence of a structural break in the forecast error, estimation is based on data from 1996-2004.
- The authors investigate several other explanatory variables, and find the results to be robust to the inclusion of other cyclical current and forward looking variables.
- The authors also evaluate their equation relative to several other specifications, and find that their chosen model outperforms a pure random walk of current spot prices, unadjusted futures prices, and a “constant-” or “rolling mean-” adjusted specification over horizons from 4 to 12 months.

Piazzesi, Monika, and Eric Swanson (2004) “Future Prices as Risk-Adjusted Forecasts of Monetary Policy”, NBER working paper No. 10547.

General Comments

- **Use of U.S. capacity utilization as a proxy for global economic activity**
- **Role of supply factors: inventories and convenience yields**
- **Forecast performance over entire sample period (1986-2004) versus post 1996**
- **Risk-adjusted forecasts systematically generate a negative forecast error**

3

- In reading the paper, several general issues came to mind, especially related to the choice of the model specification – in particular the choice of explanatory variable – in addition to a few points on the technical side.
- First, capacity utilization in the U.S. manufacturing sector does not entirely reflect global economic activity, and has significantly differed in the past -- for instance, during the Asian financial crisis of the late 1990s when U.S. capacity utilization was little affected whereas global output growth slowed sharply.
- While the paper does explain the intuition as to why capacity utilization may matter, the authors are not relying on a theoretical framework. The theoretical link between capacity utilization and forecast errors, if one exists, should be made more clear.
- In addition, this specification does not address supply factors -- in particular inventory levels, storage costs and convenience yields as discussed by Pindyck (2001). His results shows a strong positive relationship between spot prices and net (of storage costs) convenience yields.
- Finally, the authors find no relationship between capacity utilization and forecast errors between 1986 and 1996. Accordingly, in Section 3 (Predictability of oil prices in real time), they only compare forecasts from their new model with other models for the period after 1996. Does the new model still outperform over entire sample period?
- In this context, the authors could compare their results in Section 3 with the literature. For example, in contrast to this study, others (e.g. Chinn, LeBlanc and Coibin, 2005) have found that random walk forecasts of oil prices outperform futures forecast (i.e. give lower MSE).
- Based on Figure 5, it is clear that risk-adjusted forecasts perform better than unadjusted forecasts. But it is also clear that they continue to systematically under predict future spot prices (in every period period after 1997, the forecast error is negative). Therefore, risk-adjusted forecasts, like unadjusted futures forecasts, are biased predictors of future spot prices.

Pinkdyck, R. (2001) “Volatility and Commodity Price Dynamics”, MIT Centre for Energy and Environmental Policy Research, Working Paper.

Chinn, Menzie, Michael LeBlanc, and Olivier Coibion (2005) “The Predictive Content of Energy Futures: An update on Petroleum, Natural Gas, Heating Oil and Gasoline”, NBER working paper No. 11033.

Econometric Issues

- **Ex-post forecast errors appear to follow a non-stationary process. If this is the case (and capacity utilization is stationary) then the OLS results of Equation (3) would not be valid.**
- **The method used in choosing the 1995 structural break date is problematic. Hansen (1992) stated that this method may "select a candidate breakpoint that suggests a structural change, when in fact none may have occurred."**
  - **Could verify structural break with other tests -- see Andrews-Ploberger (1994) and Gregory-Hansen (1996a, 1996b).**

4

- A few technical issues on the econometrics front are worth mentioning here as well.
- First, the ex-post realized forecast error does not appear to be a stationary variable, as both the results in Table 1 and Figure 5 clearly show the variable is not mean-reverting. If the forecast error is I(1), and capacity utilization rate is mean reverting as stated in the paper, then the OLS results based on equation (3) would not be valid. It would be useful to test these variables for stationarity.
- A second issue rests with the method of choosing structural break dates utilizing regression residual plots, as identified by Hansen (1992). In his paper, Hansen stated that
  - *… [T]he data and/or regression residuals can be plotted for indications of structural change. If this is done, the timing is selected conditional on the data and the conventional approximation for the distribution of the resulting test statistic is invalid. What may in effect be done is to select a candidate breakpoint that suggests a structural change, when in fact none may have occurred.*
- When using stationary variables, I would suggest the use of the Andrews-Ploberger (1994) test to detect structural breaks. For non-stationary variables, the appropriate test is Gregory-Hansen (1996a, 1996b).

Hansen, Bruce (1992), "Testing for parameter instability in linear models", Journal of Policy Modeling, vol. 14, pp. 517-533.

Andrews, D.W.K. and W. Ploberger (1994), "Optimal Tests when a nuisance parameter is present only under the alternative", Econometrica 62(6), 1383-1414.

Gregory, Allan and Bruce Hansen (1996a), "Residual–based tests for cointegration in models with regime shifts", Journal of Econometrics 70, 99-126.

Gregory, Allan and Bruce Hansen (1996b), "Tests for cointegration in models with regime and trend shifts", Oxford Bulletin of Economics and Statistics, Vol. 58 (3), 555-560.

Final Thoughts

- **Random walk vs. unadjusted futures as predictors?**
  - **Random walk has outperformed in recent years, but neither do very well**
- **Role of economic variables in commodity price forecasting**

5

- These issues aside, as I mentioned, I found the paper to be well-written and quite useful from a forecasters perspective, and I would like to conclude with a few final thoughts on commodity price forecasting and futures prices.
- First, the authors show that a pure random walk forecast – that is, today's spot price as a forecast of future spot prices – has outperformed unadjusted futures prices as a predictor in recent years – perhaps a disturbing result for those using unadjusted futures as a forecast.
- Both, however, produced relatively large errors and were downwardly biased over the sample – perhaps not surprisingly, given the estimation covered a period of generally rising spot prices.
- More importantly, however, the results reinforce the importance of economic variables in commodity price forecasting. In this case, the authors demonstrated that economic factors can reduce the downward bias and absolute errors of futures price or random walk forecasts.
- This is a valuable contribution to our knowledge set on the issue from two perspectives: First, anything that can improve our forecast accuracy in a very difficult, yet important, area is clearly welcome. As important, however, the use of economic variables in commodity price forecasting enhances the internal consistency of an economic forecast, as commodity prices are driven as well as drivers of economic conditions.