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Is Petrobras Options Market Efficient? A Study Using the Delta-Gamma Neutral Strategy

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RESU

El objetivo de este trabajo es verificar si el mercado de opciones de Petrobras, en su forma débil, es eficiente. Para lograrlo, tratamos de obtener la utilidad sistemáticamente mediante la estrategia Delta-Gama-Neutra, utilizando la acción preferencial de la empresa y sus opciones de compra. Para simular la estrategia tal como sería utilizada en el mundo real, construimos los libros de las ofertas a cada cinco minutos, considerando todas las órdenes de compra y venta, enviadas tanto para el activo objeto como para las opciones. La estrategia se implementa cuando observamos las distorciones existentes entre las volatilidades implícitas extraídas de las opciones. Los resultados muestran que existen evidencias de que el mercado de opciones de Petrobras no es eficiente, ya que en 371 operaciones de day-trade realizadas, con una inversión promedio de R$81 mil y tiempo medio de uma hora y trece minutos, el retorno medio fue de 0,49%—lo que corresponde a más de 1600% del mayor tasa interbancaria del período, siendo que 85% de las estrategias fueron rentables.

RESUMO

Este trabalho tem como objetivo verificar se o mercado de opções da Petrobras é eficiente em sua forma fraca. Para isso, tenta-se obter lucro sistematicamente por meio da estratégia Delta-Gama-Neutra utilizando a ação preferencial da empresa e suas opções de compra. Para se simular a estratégia tal como ela seria empregada no mundo real, construímos os livros de ofertas a cada cinco minutos considerando todas
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Notes

Exponential weighted moving average, also known in the econometric literature as integrated GARCH (1,1)—IGARCH (1,1)—with null constant. This model is widely used in the financial market. See, for example, Riskmetrics™ (1996).

Delta and gamma are the first and second order measures of the sensitivity of the price of the portfolio in relation to the price of the underlying stock.

In particular, the impact of the Greek theta is practically nil due to the short term positions used in this work.

In April 2013, there was a change in the layout of the file that contains the orders generated by the Brazilian stock exchange, which makes the proper construction of the book impossible (more details in Section 2).

"Bid" is the word referring to the highest buying price of the order book, while "ask" refers to

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Section 2 will talk about the criteria for carrying out the strategy, including the distance of the volatilities.

The Black model is the version of the B-S model used to price futures options.

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As described in Raju (2012), the strategy is also feasible with puts; however, these type of options were not included in this study because, in general, they did not have sufficient liquidity in the Brazilian market during the study period.

The options with the shortest maturity are usually those with the highest liquidity.

More specifically, the information that was removed is the “date and time of the offer modification” and “number of modified offer.”

The first book of the day is built five minutes after the start of trading and, the last, five minutes before the closing bell.

These simplifications only bring more restrictions to the strategy, i.e., less likelihood of the gamma-delta neutral strategy being successful.

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already assigns different implied volatilities to the underlying asset for different option

strikes in order to resolve the distortions generated by the assumptions of the B-S model. Thus, if the distance between the volatilities is small, there is less likelihood that the option prices really reflect distortions.

We could also implement the position without using a “central” volatility (in this study, EWMA volatility), i.e., entering into the position when the distance between the implied volatilities is greater than a certain limit.

For example, consider a long position in 100 options with a strike price of 10, a short position in 300 options at a strike price of 12 and a long position in 100 of the underlying asset. In this transaction, for the 300 options sold, 100 are covered with the underlying asset and 100 are covered with the long options (since these options have lower strike price than the short options). Thus, the value of the margin in this case is 100 (number of uncovered options sold) x 12 (strike price of these options), R$1200.

Margin required by CBLC (Brazilian Clearing and Depository Corporation) for the position during the study period.

Name commonly used in the financial market for the average value of a trade.
