

BACKWARDATION IN ASIAN OPTION PRICES

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ABSTRACT. *In this paper, a convenience yield model is constructed via state price density approach. It is shown, by mathematical manipulations, that the backwardation in forward price will make the prices of Asian options high, sometimes even much higher than those of the corresponding plain vanillas. A numerical example is presented to illustrate the effectiveness of the proposed model, and verify the conjecture.*

Keywords: Convenience yield, Forward curve, Asian options, Backwardation, State price density approach

1. **Introduction.** *Backwardation* in its usual sense is a market condition where spot prices exceed forward¹ prices. As is well known², backwardation is almost impossible in a frictionless market. In a less liquid market, however, it **does** happen. Backwardation indicates an immediate shortage or some other liquidity risks. It can be seen that such a shortage often happens in a commodity/energy market, such as oil, copper, corn, etc. In fact, backwardation is not a rare event in a commodity/energy market.

¹A *forward* contract is an agreement between two parties to buy or sell an asset (which can be of any kind) on a pre-agreed future day at a pre-agreed price which is called *forward price*. In contrast, the price to get the asset immediately is called *spot price*. For details, see [9, Chapter 2 & 3].

²See section 2.1.