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**Optimal Bidding Strategy in an Agriculture Commodity Auction in Southern India**

*Selected Paper*

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## **Optimal Bidding Strategy in an Agriculture Commodity Auction in Southern India**

The objective of this paper is to find the optimal bidding strategy for a buyer of areca nut at a commodity auction in Southern India. Areca nut (also known as betel nut) is a 'nut' cultivated in South Asia, East Africa, and the Pacific Islands. Technically it is a seed that is chewed as a stimulant by at least 5% of the world's population. Chewing areca nut is a popular pastime in much of Pacific Islands and parts of South and East Asia. The world's largest producer of areca nut is India, specifically Southern India.

It takes approximately five years for an areca nut palm to mature and bear the nut. Once mature, the palm can provide nuts up to fifty years. In the past, areca nut farmers had not always practiced sustainable use of resources in areca nut production. However, the last few decades have seen a transformation in the sustainable production processes of these farmers, resulting often times in greater than typical harvests, thus leading to a rapidly growing market.

Each areca palm is harvested once a year. This limits the areca nut farmer's ability to change crop mix as the relative prices of crops change. The areca nut is considered to be a cash crop; there are thousands of households in the state of Karnataka, the largest producer of areca nut in India, that depend entirely on the income from their areca orchard. The demand for areca nut is based primarily on the consumption habits of people in Asia, specifically India. The domestic production and consumption of areca nuts are virtually equal. Still there is a small import market, which typically consists of lower quality and hence lower priced areca. This competition, along with variations in

demand and production, some due to exogenous factors, leads to considerable fluctuations in the market price of areca nut.

The price discovery process, based on an auction between wholesalers (the buyers) and the areca nut farmers (sellers) offers an opportunity to analyze a unique type of auction.

### Auction

The auction process is based on a secret tendered bid (sealed bid auction). Auctions administered by government agencies take place twice weekly all over the state of Karnataka, and are typically held at the same time and days of the week, usually around 1 pm on Tuesdays and Fridays. Prior to the start of the auction, buyers are able to discern the quality of the areca nut up for bid. Sellers make available samples of the lot they wish to sell. This is an important input into the bidding decision process for the buyer. The price of an areca nut is based on its texture, the color and other quality characteristics, particular to each buyer. The lot for sale is typically available for inspection during the earlier part of the auction day. Based on these characteristics, the buyer tenders a secret bid (written on a specific form with identifying characteristics of the buyer) for a specific lot and places it into a locked box (private-value or subjective-value auction). At 1 pm sharply, a government agency representative opens the box. Each bid is read aloud and noted. The highest bidder wins that particular lot (first-price sealed bid auction). This is where this particular auction varies from traditional sealed bid auctions. The seller (the areca nut farmer) now has the option of either accepting or rejecting the highest bid. If accepted, the seller is not obligated to offer his entire lot. He can choose to sell, at the highest bid offered, anywhere from zero to one hundred

percent of his lot available for sale. This feature gives the seller an option to otherwise reject a bid below his reservation price. There are other commodity auctions in India that guarantee a threshold price to farmers, such as the minimum government support price for rice farmers. This threshold price is previously known, as the government announces it prior to auctions. There is a similar price support for areca nut as well. The unique feature of the areca nut auction is the seller's ability to reject the highest bid, if it is below his reservation price.

We propose to study this auction to derive a theoretical solution for the optimal bid, and use actual auction data to verify the theoretical optimal bid. This will be accomplished by tweaking the auction model first introduced by Hansen (1988). There the lowest bidding seller wins a contract from the buyer. In our model, it is the highest bidder that 'wins' the contract (lot). The exception to our model, that makes this type of auction unique is that the decision of the seller to sell anywhere in the range of zero to one hundred percent of his output. In formulating the optimal bid strategy, we need to account for a distribution of possible values for the seller. This type of auction was designed to give some control to the farmers, as way to mitigate some of the price risk, normally present in agricultural commodity auctions. Using data from actual auctions we test this idea of risk reduction, by contrasting it to a standard type of agricultural commodity auction.

We believe this topic will be interesting and a good source for discussion at the meetings given its uniqueness. In addition to exposing the conference attendees to an important agricultural commodity from a developing country, it should provide some insights into

an auction market that may have possible uses in commodity markets in the US. It will also be interesting to explore this type of auction as a form of risk management.