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THE ROYAL SWEDISH ACADEMY OF SCIENCES

The Royal Swedish Academy of Sciences has decided to award the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2020 to **Paul R. Milgrom** and **Robert B. Wilson** "for improvements to auction theory and inventions of new auction formats".

The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2020

Auctions are everywhere

Every day, auctions allocate astronomical values between buyers and sellers. Auctions affect all of us, at every level – they determine the prices of housing, electricity, securities, commodities and many other things. This year's Laureates, Paul Milgrom and Robert Wilson, have developed auction theory and invented new auction formats. Their discoveries have benefitted sellers, buyers and consumers around the world.

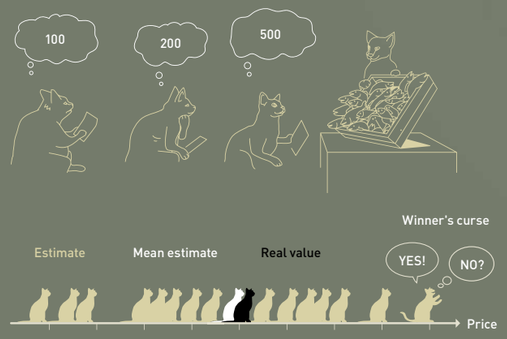
Trading goods at auctions is probably as ancient as going to the market. Nowadays, not only household objects, art and homes change hands in auctions, but also emission allowances, fishing quotas and radio frequencies. This has transformed auctions into very complex tools, where the strategic interaction between the bidders determines the outcome. Auction theory is about trying to understand this interaction and examines the consequences of different rules on bidding and final prices.

Robert Wilson developed a theory for auctions of objects with a *common value* – a value which is uncertain beforehand but the same for everyone in the end. The future value of radio frequencies or the amount of minerals in a specific area are two examples. His theory also explains why rational bidders tend to place bids below their own best estimate of the common value: they are afraid of the *winner's curse*, i.e. paying too much and losing on the transaction (image 1).

In most auctions, the object not only has a common value, but also a *private value*. For example, when bidding for a house, you consider the location of the house relative to your workplace – the private value – as well as its future market value – the common value.

Paul Milgrom formulated a general theory that takes both common and private values into account. He showed how the problems associated with the winner's curse are smaller in "English auctions" – where bids start low and gradually increase – than in "Dutch auctions" – where the price starts high and is subsequently lowered until someone accepts. This is because bidders learn more about each other's valuations as bidding progresses, making it easier to understand how accurate their own estimates of the common value are.

Over time, societies have strived to allocate ever more complex objects, such as landing slots for aeroplanes or radio frequencies for telecom operators. The purpose has been to achieve an allocation that benefits society at large, rather than maximising revenue for the seller. Milgrom and Wilson invented a new auction format in which many interrelated objects could be auctioned off at the same time – the Simultaneous Multiple Round Auction (SMRA) (image 2). This auction format was first used in the US in 1994, and many other countries have followed since.



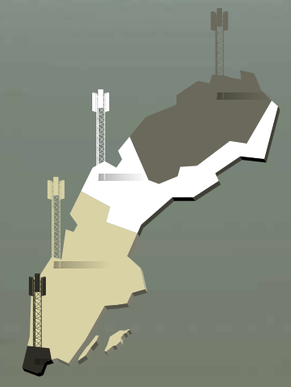
The winner's curse

No bidder knows the common value – the volume of fish in the box and what it is worth. A bidder who is too optimistic risks overestimating the common value and paying too much. The win then becomes a loss – the winner's curse. The fear of this happening leads rational bidders to offer a price below their own estimates of the common value. To avoid the negative consequences of the winner's curse, a seller should give the buyers as much information as possible – for example, house inspection protocols, results of test drilling, or certificates of authenticity.

Auctions with many objects

The Laureates invented an auction format that allocates spectrum licences to telecom operators in a way that benefits society. For example, a Swedish operator wants to create a national mobile network; if frequencies are first auctioned off in Lappland, and then down the country to Skåne, the value of a licence in Lappland depends on whether the operator manages to buy licences in other regions and at what prices. Without knowing whether it will be possible to acquire licences in later auctions, it is impossible for the operator to know what the licence in Lappland is worth. In the face of such great uncertainty, the telecom operators keep their bids low or may even refrain from participating in the auction.

The Laureates' solution was to offer all the licences at the same time to all bidders. Starting with low prices and allowing repeated bids reduces the problems of uncertainty and the winner's curse. In 1994, in the first American SMRA, ten licences were sold in 47 rounds of bidding for a total of 617 million dollars.



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