Summary of Price Discovery Process

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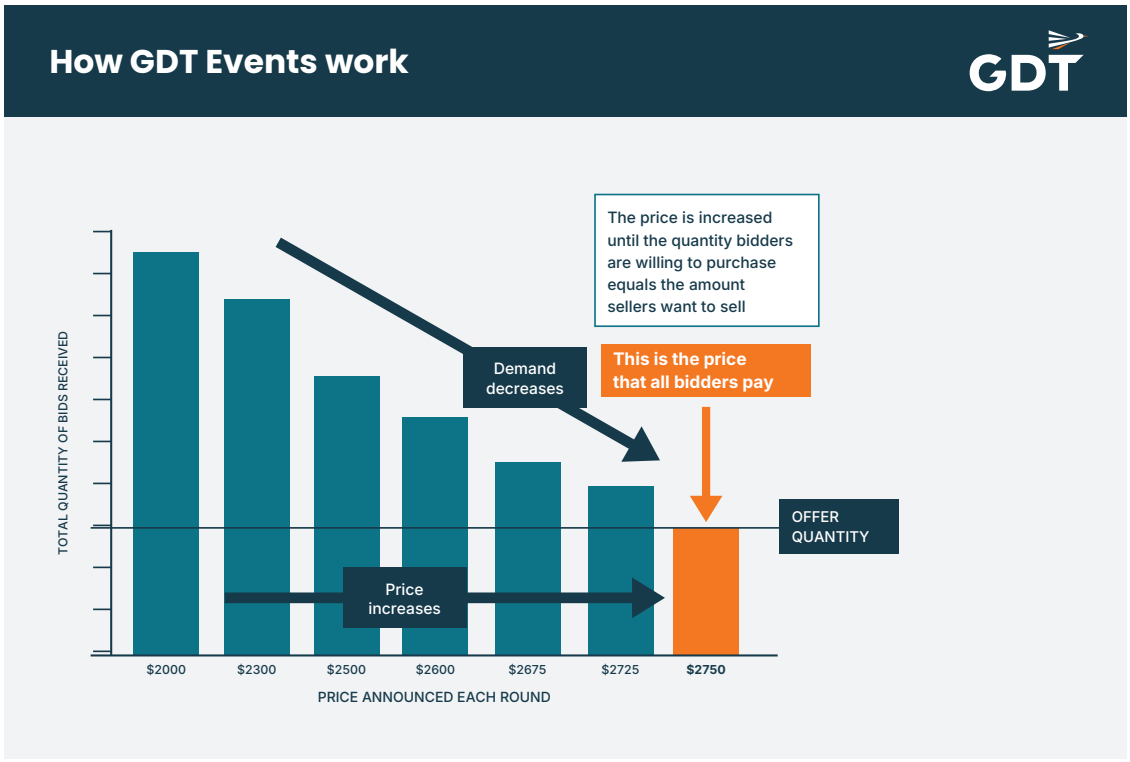
INTRODUCTION

The following provides a high level non-technical summary of how winning prices are discovered on the GDT Events trading platform.

We recommend that any reader who is not familiar with the way that GDT Trading Events are conducted through a sequence of bidding rounds should review the overview on How GDT Events Work prior to reading this paper.

The overview explains how GDT Events uses an ascending-price clock auction to discover a price level at which demand and supply are approximately balanced.

As illustrated below, the overview explains that the basic approach is to start the auction at a price where demand is likely to exceed the supply level, and then to increase the price in successive bidding rounds until the total bid quantity has reduced sufficiently that the product has ceased to be over-subscribed.



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PRICE DISCOVERY PROCESS

Fundamentally, the price discovery process tests a sequence of price levels for their consistency with balancing demand and supply conditions as expressed by buyers and sellers. Supply and demand ultimately determine the winning prices.

Supply substitution

A key feature of the GDT Events price discovery process is that demand and supply are measured at different levels reflecting the seller's ability to shift supply among products to meet demand. Such flexibility sometimes is referred to as supply-side substitution.

The process involves a round-by-round process of deriving price increments for the offered products that take into account the following factors:

(a) Demand for each individual product relative to its supply quantity specified by the seller;

(b) Where the seller has specified flexibility to shift output among multiple products within the same sales group (i.e. among products within a product group/contract period combination), the strength of aggregate bidding demand for the sales group relative to the sales group supply specified by the seller;

(c) Where the seller has specified flexibility to shift the milk components among different product types (for example, flexibility to shift milkfat between AMF Contract 1 and Butter Contract 1), the strength of the derived demand for the relevant milk components relative to their supply levels specified by the seller.

(d) Minimum and maximum supply quantity constraints as specified by the seller.

Most products traded on GDT Events fall into case (b) so price increments are mainly driven by total demand at the sales group level (e.g. demand for SMP Contract 1) rather than by individual product level demand. Case (c) currently applies only to Fonterra AMF and butter.

Demand substitution

The price discovery process also takes into account the flexibility that bidders may have to shift their demand among products and also among different contract periods for the same product. Such flexibility sometimes is referred to as demand-side substitution.

Where bidding demand either historically or during the current trading event suggests that bidders prefer and are able to shift among products or among contract periods, the price discovery process accommodates those preferences by computing price increments accordingly.

This means that the announced price for a product in a particular contract period may be influenced by the announced price for the same product in adjacent contract periods or by the announced price for other products.

Nominal limits

In general, the higher the demand/supply ratio for a product or sales group or milk component in a bidding round, the larger the price increment applied to the relevant products for the next bidding round.

Overlaying this, the price discovery process also incorporates various lower and upper limits on the nominal size of price increment that can be applied to the product. This is to try to avoid price increments that over-shoot clearing levels, and to ensure there is a nominally small but positive price increment whenever the product, sales group, or milk component is over-subscribed.

The magnitude of the limits varies across product types and may apply at different levels during the Trading Event.

The nominal limits and other constraints may sometimes prevent the supply and demand factors described above from applying equally to all products within a sales group or within a milk component group.

If at a later round, the constraints are no longer binding, or are partially relaxed, then the price increments may incorporate adjustments to bring the announced prices for relevant products back into alignment with the supply- and demand-side substitution factors.

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Manual override

The Trading Manager has discretion to override the software-generated price increments.

For example, the Trading Manager may reduce the price increment if the software-generated price increment poses too much risk of significantly over-shooting the clearing price, i.e., a large price rollback.

Or the Trading Manager may increase the price increment if demand is substantially less sensitive than normal and there is a risk the trading event could take longer than necessary without such an override.

In cases where the Trading Event has gone through many rounds, resulting in an abnormally long event, and where the last remaining over-subscribed products are close to being subscribed, the Trading Manager may either raise the price increment above the software-generated level or allow the trading event to close with the sold quantity slightly higher than the seller's supply quantity.

This has the effect of allowing more of bidder demand to be met while remaining within the contingent supply quantity the seller has set for this purpose.

Subscription and pricing status

All of the above are subject to two overriding rules:

- If a product is either under-subscribed or has a two-price bid stack (refer below), then it must not have a price increment;
- If a product is over-subscribed, then it must have a price increment greater than zero.

If a product is neither over-subscribed nor under-subscribed and does not have a two-price bid stack, then its price increment may be zero or positive depending of the factors described above.

Rollbacks and two-price bid stack

The winning price for a product depends on whether the product was subject to a rollback and ends the Trading Event with a two-price bid stack.

If a product or sales group or milk component group is under-subscribed following a bidding round, but was subscribed or over-subscribed in the preceding round, the software will use an algorithm to apply a rollback to one or more of the relevant products.

A rollback results in the product having a two-price bid stack, where:

- The higher price is the announced price from the round that just ended;
- The lower price is the next-highest announced price from the preceding rounds.

The total quantity accepted on the product comprises all the accepted bids made at the higher price and a portion of the bids previously made at the lower price, with the total accepted bids satisfying at least the seller's minimum supply quantity.

The rollback quantities are selected randomly in such a way that it approximates proportionality across bidders, subject to satisfying the various supply and demand constraints. The Trading Manager does not have discretion to override the software-determined rollbacks.

In any subsequent bidding round, new bids can be made only at the current announced price (i.e., higher price) and any such bids displace an equivalent quantity of lower-price bids. If sufficient bids are received at the current announced price to knock out all the lower-price bids, then the product reverts to a single-price bid stack, i.e., all bids in the bid stack were bid at the current announced price.

At the end of the trading event the winning price for each product is determined as follows:

- If the product has a two-price bid stack, then its winning price is set equal to the lower of the two prices;
- If the product has a single-price bid stack, then its winning price is set equal to the prevailing announced price, being the price at which all the bids in the bid stack were submitted.

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SUMMARY

Summarising the above, the winning price for a product is influenced by four main economic factors:

- The strength of bidding demand relative to supply quantity offered by the seller;
- Whether the seller offers the product on a stand-alone basis or as part of a larger sales group or milk component group;
- The extent to which buyers prefer to switch among products and/or adjacent contract periods in response to price differentials; and,
- Minimum and maximum supply constraints specified by sellers.

The winning price is also influenced by whether the product is subject to a rollback and ends the Trading Event with a single-price or two-price bid stack.

Both the price increment parameters and the Trading Manager's manual interventions aim to avoid large price rollbacks, but the demand response to a price increase sometimes can be abnormally large.

In terms of round-by-round activity, the size of the price increment applied to a product that is eligible to receive an increase is determined by:

- The demand/supply ratios at the product level, sales group level, and milk component group level;
- The extent of any price divergences among demand-side substitutable products and/or adjacent contract periods;
- Nominal dollar limits on the size of price increments;
- The extent to which the nominal dollar limits or other constraints are binding or ceased to be binding;
- Whether the Trading Manager overrides the software-generated increase to raise or lower the price increment.

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